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ABSTRACT

Over 40 activities dealing with marine animals comprise this guide for first-grade teachers. By combining meaningful time at the beach with appropriate classroom work, first graders should be able to learn about the habitats, lives, characteristics, and names of some common ocean invertebrates, fish, and mammals. In addition to the lesson plans for indoor and outdoor studies, the manual includes 32 student worksheets which may be duplicated. Also provided are tips on organizing and conducting a field trip, and a bibliography of helpful references. (Author/WB)

DRAFT

SEA ANIMALS

A Study Guide for the First Grade

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ALASKA SEA WEEK CURRICULUM SERIES

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ACKNOWLEDGEMENTS

Sea Week began in the early 1970's in Juneau, Alaska. Under the leadership of Mary Lou King, parents, teachers and agency personnel started taking elementary school students down to the sea every spring. Soon, Sea Week was an annual event with some of the junior high and high school students assisting the younger pupils on their field trips to beaches, wetlands, forests and glaciers. In 1978, a K-6 Sea Week curriculum was written with the assistance of Juneau teachers, scientists, fishermen, parents, and government employees - a true community effort. In 1979, the Southeast Regional Resource Center revised the material, adding worksheets and graphics and reworking certain activities. In 1980, endorsed as "The Year of the Coast" by President Carter, it seems very fitting that the Alaska Sea Grant Program is initiating a program to spread Sea Week statewide.

This first statewide edition is a product of Juneau - its people and environment. We would like to express our deep appreciation to the many foresighted people who contributed to Sea Week and especially to all the students who are the reason and impetus behind its success. Special thanks to Mary Lou King, Nancy Barr, Janie Cesar, Carol Koski, Dick and Betty Marriot, Virginia Eggert, Claudia Kelsey, Kathy Hanna, James G. King, Lynn Szepanski, Karen Gunstrom, Mary Beth Parsons; Dan Hopson, Kristi Kantola, Pat Thrasher, Tamara Smid, Judy Maier, Jerry Hard, Marty Early, Jan Conner, Mark Hansen, the Alaska Department of Fish and Game, the Alaska Coastal Management Program, the United States Forest Service, the Alaska Department of Environmental Conservation, the United States Fish and Wildlife Service, and the South East Regional Resource Center.

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PREFACE

The Alaska Sea Week Curriculum Series (K-6) emphasizes one or more aspects of the marine environment at each grade level. Kindergarten materials, for instance, are intended to introduce students to the exciting and curious world of the sea and shore. At the other end of the series, materials for sixth graders stress man's interactions with the marine environment. While the subject matter at each grade level is unique, as a whole the grade level guides will yield a broad understanding of the marine environment and its importance to Alaskans.

The purpose of this curriculum series is to help the teacher in interpreting the marine environment for elementary school students. However, what is included here is just a place to begin. As you read the following materials, you will find factual information about many aspects of the marine environment, and suggestions for presenting these concepts to students through multi-disciplinary activities both in the classroom and at field sites. Materials are organized into units, each covering a single idea or subject. From these you, the teacher, may select the units and activities which are best suited to your class, community and resources.

"Sea Week" originated in Juneau, and these curriculum materials are most applicable to southeast and southcentral Alaska. However, the Alaska Sea Grant Program has funded a three year pilot project to expand Juneau's successful program statewide. As Sea Week is piloted in 14 communities around the state, the Curriculum Series will be expanded to meet the needs of western, interior, and northern Alaska.

Send us your comments and suggestions. The strength of the final edition will depend not only on those of us staffing the project - but on you - your ideas and comments. After you've tried some of these activities - fill out and send in the evaluation sheet at the back of this book. Thanks so much!

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INTRODUCTION

Alaska has more than 33,000 miles of shoreline; the earth's circumference is only about 25,000 miles. Much of Alaska's complex and intricate shoreline is accounted for by the bays, inlets, headlands, islands of Southeast Alaska. Here, in Alaskan communities large and small we live in close contact with the marine world. Some of us make our livings by fishing or working for the Coast Guard, the State's marine transportation system, or marine shipping companies. Most of us spend at least some of our time sport fishing, digging clams, beachcombing, or just gazing out at the incredible scenery of snowcapped mountains and everchanging inland waters.

The dynamic marine environment of which we are a part is our heritage, our trust. It is only fitting that our children know that world intimately so that they can grow up in an understanding of its complexities, it subleties, its importance. This is of particular urgency now that Alaska is facing increasing pressures to make decisions that will effect the use of her lands and seas for generations to come. We, and our children, must have a part in the decision making processes and the more knowledgeable we are, the more effective our participation will be.

Teaching children about the world in which they live is important and perhaps it has never been more important than it is in Alaska today. Teaching facts and concepts about the marine world is important but perhaps most important of all is the teaching of attitudes. It is hoped that through the study of marine life, students may gain the following:

1. An increased interest in their environment.
2. A greater awareness, appreciation, respect for the natural world that is so close about them here in Alaska.
3. The sheer delight, pleasure, happiness that can come from observing and understanding nature close up.
4. A sensitivity to the relationship between themselves and their environment.

If that can be accomplished, all our lives will be better because of it....

INTRODUCTION - FIRST GRADE

Of all the aspects of the marine environment and marine life, the widely diverse animal forms are perhaps the most intriguing to grade school students - and to adults as well! Although in first grade it is not possible, or advisable, to go into any great detail about the complex diversity of these life forms, it is possible to lead students to an understanding of some basic concepts about marine animals and to introduce them to the major phylogenetic groups that they will encounter on any trip to the beach.

Most young students are truly eager to learn and they love knowing something that is "true". Their capacity for learning is impressive if materials are presented to them in such a way that they can understand them. By combining meaningful time at the beach with appropriate classroom work, it should be possible for first graders to learn the following:

1. Some of the distinguishing characteristics of major groups of marine animals.

2. Something about where members of those major groups might be expected to be found and about how they live.

3. Common or scientific names of some of the inhabitants of our beaches and seas.

4. Recognition of some of the common animals and some of their distinguishing features.

Through the teaching of facts about marine animals can come the learning of skills which are important, too. Through their sea life studies, for example, children may:

1. Improve their skills in observing - in noticing differences and similarities.

2. Sharpen their problem-solving skills by trying to figure out how to do something they, as individuals or as a class, would like to do.

3. Sharpen their reasoning by trying to figure out the whys of some of the things they observe.

WHAT IS A MARINE ANIMAL?

Teacher Background

Many of us intuitively know what a plant is and what an animal is but to actually put those definitions into words may be a little bit harder. The suggested activities and discussion ideas that follow are intended to help first graders verbalize the difference between the two groups and then further discover why marine animals must be different from animals that live on land and how they have specially adapted to their environment. These ideas might be handled well in advance of Sea Week, particularly since the concept of "plant" and "animal" could well apply to many areas of study other than that of marine life.

WHAT IS AN ANIMAL?

WHAT IS A PLANT?

Materials

Pictures: these can be brought from home or cut out from materials in the classroom-

- plants
- animals

Live Materials: things that might reside in the classroom or that the children have brought in to share-

- growing plants
- gerbils, hamsters,
- fish
- insects

Procedure

Statement: All living things in the world are either plants or animals.

1. Lead the students to distinguish between plants and animals by:

   - have each child makeup a book or poster(s) to show members of each group.
   - put together a bulletin board with pictures of animals and another bulletin board of plants.

   or

   - a group discussion of the two groups with the entire class.

2. After the discussion of these two groups, ask:

   what is a plant?
   what is an animal?
   what makes a horse an animal?
   what makes a tulip a plant?

3. Bring the discussion to the point where the children recognize the ideas that:

animals - must eat actively to survive. They eat other animals or plants.
- may be almost any color and may take many shapes and textures but are usually not green.
- are usually capable of some sort of motion.
- must breathe in air (oxygen) to survive.

plants - are usually green.
- make their own food. They do not usually rely on eatin other organisms.
- are usually fixed in one location.
- must breathe air (carbon dioxide) but it is the part that animals breathe out as waste.

The two groups are very dependent on each other!

Teacher Background

Although the main differences between plants and animals are firm and established, there are many exceptions to the rules and some of these might be discussed with the children. You might, in fact, explain:

1. Plants and animals are extremely diverse.
2. There are some organisms (minute drifting forms) that scientists still are not sure whether to call plants or animals. These are often mobile (an animal characteristic) but may have chlorophyll and produce their own food (a plant characteristic).
3. Some plants are non-green and are parasites or saprophites (deriving their food from dead or decaying organic matter), but in other ways qualify as plants.
4. Microscopic plants are drifters.
5. Many marine animals are permanently fixed to a certain location.

In general, students should be led to understand that such diverse forms as humans, whales, spiders, snakes, fish, and even tiny creature so small that we can't see them with our naked eyes are all animals. Understanding this will make it easier for them to accept the diversit of animal forms they will see on the shore.

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ACTIVITY

If a microscope is available, students may be fascinated to be able to look at microscopic life forms. This can be done by placing a few drops of pond water or marine water under the scope. To prepare this live material, pull a fine mesh strainer, preferably a non-vegetable fiber netting, although even cheese cloth would be worth a try, through the water repeatedly.

****

Then wash the strainer down into a container with the same kind of water it strained through. The organisms will concentrate in the bottom of the container making it easier to get a good number of them under the scope. If the materials are refrigerated soon after collection, they may still be alive for later viewing. Otherwise, they may be preserved by introducing a small bit of formaldehyde to the container. Generally, green things are plants; other forms are animals.

HOW CAN AN ANIMAL LIVE IN THE SEA?

Materials

Pictures: perhaps a bulletin board showing different kinds of animals that live in the sea -

whale
fish
snail
anemone
clam
worm
starfish

Procedure

Review: All these marine life forms are animals even if they don't look much like our familiar land animals.

1. Ask the students

   - what difference would it make whether you lived on land or in the sea?

2. In the discussion of this question, include the following ideas:

   Breathing: animals must breathe, but how would you breathe in water?

   We, for instance, can't put our heads under water for long but must, instead, surface to take in air. Some animals that live in the sea (mammals) do the same thing. Ask the children if they have ever seen this. Perhaps they will mention seals and sea lions that stick their heads up to breathe and whales and porpoises that have a special blow hole on top of their head that opens when they surface to expel air they have breathed in and then to draw in a fresh breath.

- Have you ever watched someone clean fish and seen the red gills under the curved flap just behind the fish's head?

Fish can't live outside of water for very long. Their gills are a special adaptation that fish have for breathing under water. All animals that live in the sea have their own special ways of drawing oxygen (a component of air) out of the water so they can survive.

Movement

We and other animals are best fitted for walking or flying or otherwise moving over a land covered by air but water is "thicker" and often has more persistent, stronger movement (currents) so that animals that live in the sea must adapt in ways different than those used by critters that live on land.

- some marine animals anchor themselves firmly to the bottom so they withstand the force of the waves.
- some burrow into the bottom (clams and worms).
- some move through the water (the marine equivalent of flying).

Discuss ways in which fish and whales move their bodies to propel themselves through the water. (it is helpful to have pictures)

- whales move their tails up and down.
- most fish move their tails from side to side.
- sea lions rely primarily on their powerful forelimbs to propel themselves.

* *
*
* ACTIVITY
*
* You might introduce here the idea that the sea is salty. Be sure to have the students TASTE the sea when they go to the beach. Tell the students that most marine animals can live ONLY in salt water and that they must even have a particular concentration of salt which often differs from different animals in order to survive. You cannot take animals from the sea and put them in a bucket of tap water and expect them to survive. Temperature is important, too. The sea in Alaska is cold and the animals that live in it are adapted to that temperature and will die if the water becomes too warm.
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SPONGES

(Porifera)

WHAT IS A SPONGE?

IN THE CLASSROOM

Materials

One old-style, honest to goodness sponge (not the plastic foam type)

Procedure

Statement: (let the class examine the sponge while you tell them about it)
The tan mass full of holes was once an animal that lived at the bottom of the ocean. Some sponges have a definite shape but many of them grow as masses with no set shape and they just continue to grow and extend as long as they live.

AT THE BEACH

Because they are such totally sedentary, unmoving creatures, sponges don't really lend themselves to making any on-site observations. But, children can:

- recognize a sponge when they see one,
- have the opportunity to feel them,
- think a bit about where they grow.

Teacher Background

We have sponges here both deep beneath our marine waters and intertidally. The intertidal sponges are usually rather inconspicuous, encrusting kinds that tend to prefer growing under the overhangs of rocks or in crevasses although sometimes they may cover exposed boulders. Often they are shades of green or yellow, but they may be found in other colors as well. If you touch a living sponge on the beach, it will feel spongy, as it should. If you were to look carefully at the local encrusting sponge, you would see that it has many volcano-like holes in it.

The large holes visible in a mass of sponge are the excurrent openings, part of the animal's method of feeding. There are also smaller openings through which water enters the sponge mass. Cells along the internal passage capture tiny food items, then the water passes out through the large, obvious openings.

Many sponges are given shape and texture by tiny, often elaborate silaceous or calcareous structures called spicules. Spicules are used taxonomically to identify many species of sponges, for each one has a particular variety and size of spicules, that are peculiarly its own. Spicules are easy to see under a microscope and their shapes are fascinating.

ACTIVITY

Materials:

- microscope
- bit of sponge material from beach
- Chlorox
- eye dropper
- microscope slide

Procedure:

To prepare the materials:

1. take a bit of sponge
2. place it in a small container
3. add a few drops of undiluted Chlorox
4. swirl around or stir with a glass rod until the sponge material visibly starts to disintegrate.
5. with an eye dropper, carefully draw some of the Chlorox and what it now contains out and deposit a drop of it on a slide.
6. cover with a cover slip and place the slide under the microscope.
7. Voila! you should have a variety of spicules to examine.

If you have available bits from several kinds of sponges, try them all. Among those containing spicules, you will see different kinds and combinations of spicules with each different species.

SEA ANEMONES, JELLYFISH

(Cnidaria)

* * * * * * * * * * * * * * * * * *
* WHAT IS A SEA ANEMONE? *
* * * * * * * * * * * * * * * * * *

IN THE CLASSROOM

Materials

film
blackboard drawing that show what the anımal looks lıke
poster

Procedure

Question: Does anyone know what this ıs? (Some first graders wıll probably recognize ıt.) Either way, you can lead to several questions about it...

1. Is it a plant or an animal?

If the students don't already recognize ıt, you can tell them ıt lives in the sea. From there, you might ask ıf they need to know any of the following:

- whether it moves or not? Not all anımals move. Sponges, for example, are anımals but never move from the rocks on which they start to grow. There are many tıny plants ın the sea that move by beatıng wıth whip-like structures but nevertheless, they are plants. Although most anımals can walk or run or otherwıse move, not all of them can and some plants can move by themselves as well. Beıng able to move ıs not a sure way of tellıng a plant from an anımal.
- what ıt eats? Most, but not all, plants have pigments that allow them to manufacture their own food but anımals are never capable of this and must depend on eatıng plants or other anımals. When talkıng about feedıng as a criterıon for beıng an anımal, point out to the children that the anemone has a mouth (located ın the center of the rıng of tentacles). The tentacles can fold ın toward the central mouth bringing wıth them bits of food that chance to settle there..

2. What does it look like?

Using a diagram, point out the parts of the anemone to the chıldren:

- a broad base with which it holds on to the rock,
- a column,
- tentacles around what is called the oral disc.
- a mouth in the center of the oral disc.

There are three species in our area that can be seen on a low tide!

A. The common intertidal anemone is quite small; perhaps to about two inches in diameter across the oral disc and tentacles. It comes in a range of colors - red, pink, gree, etc. - always with bandings of lighter and darker shades of the main color along the tentacles. These small anemones can often be found in tide pools with their tentacles fully extended. (Anthopeura artemesia)

B. The large anemone commonly exposed at low tide (Tealis crassicornis) is patterned in green and red.

C. The third species also found intertidally (Metridium senile) is usually white and differs from the other two species in that its tentacles are finely branced so as to appear almost feather-like.

An anemone has no bones and needs water - both inside and outside - for support. When they are out of water on the beach, they will look like unappealing masses of gelatinous material. If you look out into the water, you will probably see anemones that are upright and beautifully expanded because they are in their proper element. The small anemones in a tide pool are also examples of what the animal really is.

3. Characteristics not true of any anemone listed above:

   A. some anemones live in tubes of their own making that extend down into the substrate. These anemones extend out of their tubes to feed but may withdraw into them if threatened.

   B. others are relatively mobile, flopping over and over slowly like someone doing a cartwheel.

   C. at least one species actually lets go of the bottom and with writhing motions will feebly swim. All this in response to particular predatory starfish.

4. How does an anemone reproduce?

Anemones may reproduce in several ways:

   A. Like many animals in the sea, anemones develop eggs in order to reproduce more of their kind. The eggs grow inside the anemone and are then released through its mouth. The fertilized eggs grow into tiny forms that drift for awhile before settling to the sea floor to grow into adults.

B. An anemone may also reproduce by stretching itself apart into two halves, dividing itself top to bottom through the center of its column and oral disc to form two anemones where there was one before.

C. In some species, tiny new individuals attach and grow along the side of the column of the parent, becoming free when they reach a certain size or maturity.

AT THE BEACH

Materials

undisturbed anemones in a tide pool
small particles of varying types
- bits of shell
- food from someone's snack
- a bit of meat from a beach animal; i.e., piece of meat from a crushed mussel
- etc.

Procedure

Have the children look for anemones that are undisturbed in tide pools. Caution them not to disturb the animals by poking them or by disturbing the water in the pool. Sneak up on them!!

Children might also be encouraged at the beach to see how many different kinds of anemones they can find. Can they describe them? How are they different? Do they find them both in their upright and collapsed states?

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ACTIVITY

Try placing a piece of "food" on the tentacles of the anemone and watch what happens. The anemone will probably fold its tentacles toward its mouth and take in the material. This can be tried with several anemones and/or several kinds of food. If some of the children are really fascinated and patient, have them watch the anemone carefully for an extended period after it has taken in the food to see what happens.

- does it unfold its tentacles again?
- has it swallowed the food?
- does it "spit out" something it doesn't want?

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ACTIVITY

If there are enough anemones available on the beach, have the children gently put a finger on the tentacles of the anemone. They can feel a slight prickling sensation as tentacles close. If the child is not skittersh, he or she can leave his or her finger there as the anemone moves it harmlessly toward the mouth.

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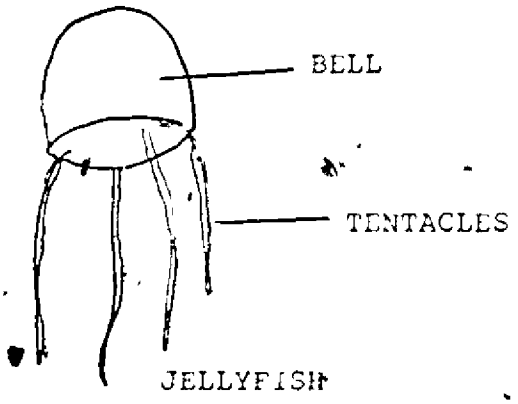
Classroom Follow-Up Activities

For these animals, the activities must be limited for it is not practical to try to bring specimens back to the classroom, either alive or dead.

Perhaps, though, if children were asked to draw or paint a picture of the beach showing the things they saw there, you would find local cnidaria in the pictures!



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* WHAT IS A JELLYFISH? *
* * * * * * * * * * * * * * * * * *

Materials

good visual materials:
- film
- diagram
- poster

Procedure

Question: How is a jellyfish like an anemone?

- Both are soft (jellyfish even shake like a bowl of jello)
- Both lack supporting, hard skeletons and take their proper shape only when supported by water.
- Both jellyfish and anemones have tentacles
- Both have a mouth in the center (jellyfish on the underside and anemone on the upperside) and the tentacles convey food to the central mouth.
- Both can sting. Someone may point out that jellyfish sting you and indeed this is true. Stinging cells called nematocysts are in the tentacles of the animal and function to stun prey. The nematocysts of our local jellyfish can irritate the skin and sting if one handles or brushes against the tentacles. The sting of some jellyfish species in other parts of the world can be so severe as to be fatal to humans. Anemones too have stinging cells but there is no danger in handling an anemone because the nematocysts are so weak that people can't feel their sting.

Jellyfish and anemones are indeed very similar. In fact, they are rather closely related. Many kinds of jellyfish do not have offspring that look like themselves but rather have "children" that look like tiny anemones. These minature anemones, in their own turn, have offspring that are the jellyfish (or medusa) form. Such alternation of generation is common among several groups of the Cnidaria.

AT THE BEACH

If you encounter jellyfish on the beach, they will probably be found stranded on sandy stretches. Should you be fortunate enough to find one, be sure the children have a chance to see it and to observe its parts

- gelatinous bell
- tentacles
- perhaps, mouth

Poking the stranded animal gently with a stick will quickly show the jello-like nature of it. Caution the children, however, not to touch it because of the possiblity of being stung.

Do not try to net jellyfish, as the net will cut and kill them.

WHAT IS A WORM?

Teacher Background

Worms are an important but often inconspicuous part of any beach. For the most part, these animals are very specialized in the terms of the particular kind of habitat in which they can be found and in their adaptations to that habitat. There are, for instance, worms that live:

1. naked in sand or mud substrates,
2. commensally with larger animals,
3. in parchment-like or calcareous tubes..

Although the idea of worms may not be the most appealing to many people these animals serve an important, often positive function in any environment. They loosen the substrate and utlize minute food matter, often debris of one sort or another, and by doing so get that nutritive material into the food chain where, by being eaten themselves, it may give profit to higher animals.

The term "worm" as it is generally used refers to a vast number of slender, wiggly animals with or without appendages. Four main groups or phyla of worms may be easily found on our beaches, each quite different from all the others.

1. Platyhelminthes (flatworms)

Some of these are as much as four inches long but most measure only a fraction of an inch in length. They are very flat little creatures that seem to flow over a surface, often just looking like a mottled spot moving over a rock or shell. They may be found on moist surfaces and are most interesting to watch closely through a magnifying glass.

2. Nemertinea (ribbon worm)

These worms are round, sometimes highly colored, and stretch like rubber. A specimen may be a foot long when contracted and stretch to ten feet long if pressure is applied. They often break apart easily and each severed part is capable of producing a new individual. They feed by everting a mouth apparatus called a proboscis. Some ribbon worms are to be found burrowed into sand or mud while others may live coiled up among clusters of barnacles or mussel shells.

3. Sipunculoidea (peanut worms)

So named because of their bulbous shape, peanut worms are burrowers in sand or mud, usually in shallow intertidal areas. They may be

several inches long and, if you dig one up, you'll find them unmistakable because of their relatively large size and their shape.

4. Annelida

The annelids are a large group of worms, the members of which are easily recognized because their bodies are segmented. The head of an annelid is well-developed and has sensory appendages on it. Most segments of the worm have a pair of paddle-like parapodia that are used for walking, digging, and the like. Annelids come in a great variety of sizes and appearances. There are annelids whose backs are covered wtih scales (scale worm), annelids that live in calcareous tubes (the tube worm) and annelids that live in cones made of cemented sand grains.

ACTIVITIES

In The Classroom

Attitude is important! Children should learn that worms are a natural, important part of the environment. They should not feel squeamish about handling them or observing them carefully. If you can, go digging and looking for worms ahead of Sea Week. Bring them into the classroom in a container of beach mud or sand, and let the children look carefully at them. Ask some of the following questions?

- how big is the worm? (measure by hand length, ruler, etc.)
- what color is it?
- does its body have segments (rings)?
- how fancy or plain is its head? (use a magnifying glass) why? (worms that crawl over the surface and hunt actively usually have more developed sensory apparatus on their heads.)
- how many legs does it have?
- does it move fast or slowly?
- will it stay in your hand when you hold it?

****

At The Beach

Encourage children to include worms in the animals they look for and find on the beach. Look for worms when you are digging for clams or cockles. If worms are found, you might ask any of the questions above as well as the following:

- where did you (we) find this worm?
- how does its appearance fit with where it lives?
- did you (we) find it alone or were there other worms like it living there too?
- how would this worm protect itself from some larger animal that wanted to eat it?

Don't overlook worms living in tubes. Although destruction on the beach is not encouraged, by gently tapping a tube worm's calcareous covering you may be able to break it and extract the entire worm. This is worth doing once to show the children what lives inside the twisting tubes they often see. Look carefully - best with a magnifying glass - at the plume-like, elaborate feeding apparatus that the worm extends into the water to catch food particles.

CRABS, BARNACLES, SHRIMP, AMPHIPODS
(Crustacea)

Teacher Background

The Crustacea are a large group of animals and are closely related to insects, sharing with them the characteristics of a hard, external skeleton and jointed legs.

On local beaches one is apt to find a number of very differing kinds of Crustacea:

1. Amphipods - small, wiggly, laterally compressed animals mostly covered by a shell but with actively kicking legs extending from their lower side. These are the cleaners or scavengers of the beach and are found under rocks.

2. Hermit crabs - these crabs are located in the lower intertidal zone. Although there are a number of local species, the most commonly found one is quite small and rather inconspicuous, often noticed first when one sees a small snail shell moving faster than one would expect a snail to travel.

3. Commercial crab species - shells of the three species are often washed up on our beaches. The three species are the King crab, Dungeness crab, and Tanner crab. With a bit of practice and thought, it is easy to identify which of these three crabs a found piece of a leg or pincer came from. In the spring, too, one often finds tiny (less than 2 inches in total diameter) King crabs in the intertidal zone.

4. Barnacles - strange crustaceans, nearly ubiquitous on our beaches, that attach themselves permanently to rocks or other substrate and sweep through the water with their legs to feed.

* * * * * * * * * * * * *
* WHAT IS A CRAB? *
* * * * * * * * * * * * *

Materials

Pictures of different crabs
Crab shells
Film strip

Teacher Background

In this section we will be discussing King Crab, Dungeness Crab, and Tanner Crab. These three species are large and abundant in our local waters. Probably most children have seen King Crab sections complete with shell for sale in our food markets as well as Dungeness Crab. A good place to start to tell children about crabs and about Crustacea in general would be to have them bring in sections from home, watch a film strip or look at pictures of crabs.

Procedure

Question: How does a crab grow if it has a hard shell on the outside of it?

Growth

On the beach you are apt to find deserted crab shells that will start to answer this question. If the shell appears to be complete, look on the rear underside of it. There you will find a slit-like opening. This is the exit through which the living crab backed out as it left its old shell in order to grow.

The process is complex but basically what happens is that beneath the hard outer shell of every Crustacean, there begins to form another larger shell. This new shell beneath the old is soft, wrinkled, and molded to fit over the animal yet under a shell smaller than it is. When the time is right and the new shell is sufficiently developed, the old shell splits and the soft animal emerges. For a period of time the soft-shelled animal is extremely vulnerable to predators but the the new shell which has expanded to its intended size and shape hardens and the animal is once again fully protected by its exoskeleton (outer shell). Some females can reproduce only while in this soft stage. The male guards her while she is soft and vulnerable.

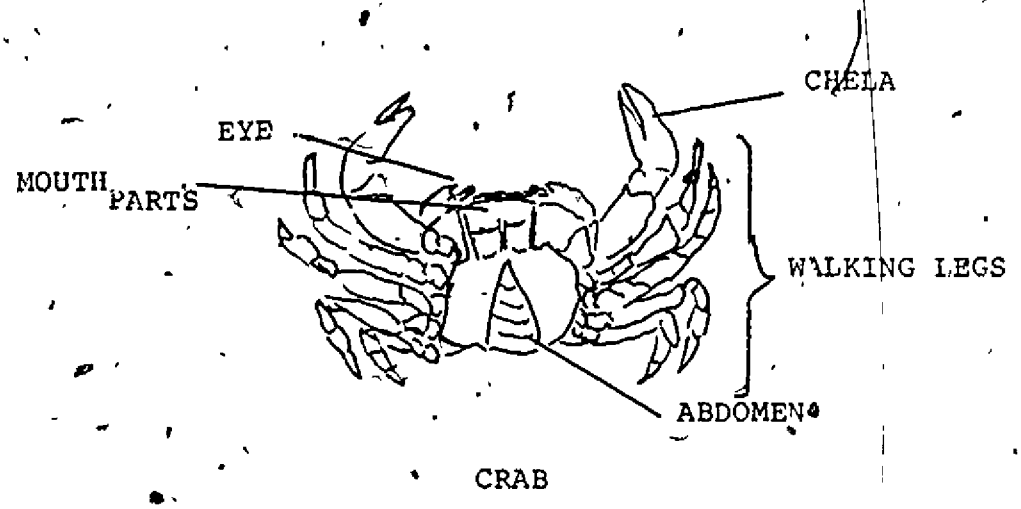
All Crustaceans grow in this manner, even barnacles whose tiny, translucent "skins" often can be found drifting discarded in inshore waters in the spring. The younger the animal, the more rapid its growth and the more often it must shed its exoskeleton. As the animal grows older, it molts less and less frequently.

Question: How does a crab move?

Movement

The jointed legs of a crab and its general body shape are related to the fact that most crabs move sideways just as often or more often than they move forwards or backwards.

Most children have tried doing the crab walk in gym class - walking on all fours but with the face and stomach facing up. Another way to have them demonstrate to themselves how a crab walks is to ask them to cross their hands at the wrists and then move their fingers as if they were walking forward, backward, and sideways. They will easily see that the fingers of one hand pull and those of the other push when sideways movement is wanted. What they have reproduced with their fingers is just what happens when a crab is walking on the beach or on the bottom of the ocean.



CRAB

Question: How does a crab eat?

Feeding

Most crabs feed on whatever they happen to come across in their wanderings. They feed on live animals such as clams, snails and starfish and also scavenge on remains of dead animals which they find. They are usually equipped with large chelae or claws with which they can catch or pick up food. The powerful claws are especially well adapted for pulling and tearing apart food items, which are then carried in the claws to the complex mouth area.

Types of Crabs

1. King Crabs. These are the best known of the Alaskan commercial species. They are also the largest Alaskan crabs, reaching a total of over 4 feet and a weight of over 20 pounds. Actually there are two species in this group: Paralithodes camtschatica, the more common red king crab and Paralithodes platypus, the blue king crab. The latter is identifiable by the blue color on parts of its shell and its different spination. Otherwise, the two species look very similar.

The life history of king crabs is interesting. Eggs hatch in the spring and the young drift in open waters for about two months before they settle to the bottom, having already molted several times and changed in appearance from a swimming form to one that is more like that of an adult crab. When it is very small, the young king crab hides among rocks and algae for protection. As it grows older, it will join with other king crab its own size to form large groups or pods, that may move over the bottom like a living ball of red spines and tiny claws. At this stage they have traded hiding for numbers as a means of self-protection. As it continues to grow, the mere size of the crab itself affords it protection and individuals begin to move away from the pod.

With maturity, the king crab's behavior assumes another pattern. Part of the year it spends living in deep waters but every year in late winter or early spring it and its kind move into shallow waters like

those here in our area to mate. Beginning in late winter, males seek out females of the species and carry them in their chelae until they molt. As soon as the female molts, mating takes place and the two separate. The female's eggs are deposited under a flap beneath her body and she carries them there for almost a year, tending them carefully to keep them clean. The following spring the eggs hatch and the cycle begins again. Some of the adult males also molt while in shallow water but those that do will not be involved in mating while their shells are soft.

King crabs are easily identified by their size or by the spininess of their shells. No other common local species has the sharp, conical spines that a king crab carries all over its back and on its legs. This quality of spininess makes it easy to identify even from a small piece of shell. An undamaged king crab will have 6 walking legs in addition to its 2 pincer-equipped claws.

2. Dungeness Crabs

Dungeness crabs are smaller than king crabs; brown in color; have no spines on top of the carapace; and tend to tuck their legs up beneath them rather than assuming the sprawling posture of the kings.

These animals spend a great deal of time buried in the sand with nothing but eyes exposed. Sometimes, in fact, they can be found still buried in the sand after the tide has gone out. Look for a semi-circular depression in the sand and dig carefully.

Dungeness are fast moving, feisty critters that can pack a mean bite with their chelae if they feel they are threatened. Always pick up a crab by grabbing it with one hand at the back of the body. In that way you are out of reach of the chelae.

Dungeness shell parts can be recognized without too much difficulty. The shell covering the back of the body is almost semi-circular along the front edge with the back margin looking rather like three sides of a hexagon. The leg segments are relatively short, without large spines, and are relatively broad. Think of the crab as it might be capable of drawing the leg tight up underneath its body. The Dungeness will have 8 walking legs in addition to its two pincer claws.

3. Tanner Crabs

These crabs will probably not be found on the beach at all. Only their shell parts will be there. They are really intermediate in size and shape between the king and dungeness. Their legs are long and sprawling, like those of the king, but they lack large spines. The crab is a brown color when the shell is old, pink when it is newly molted. The shape of the body is more or less oval with a large spine extending forward on the outer side of each eye socket. Like the Dungeness, the Tanner crab has 8 walking legs with 2 pincer claws.

ACTIVITIES

In The Classroom

Talk about what crabs look like and how they grow. Bring in molted shells or shell parts and talk about them.

- compare them
- think about how a crab would run on those legs
- ask why the leg terminates in a slender point instead of some sort of foot
- see if you can distinguish three kinds of common commercial crabs by their shells

* *

At The Beach

Look for tiny king crab. If you find them, sit down and observe them.

- what they do
- how they move

Collect crab shell parts that have washed ashore. Either talk about them there or take them back to the classroom for further discussion.

* *

Follow-up

Dungeness, King, and Tanner crabs are all excellent eating. If it can be arranged, bring in cooked crab of one or more than one of these species to eat with the class. The process of dismembering a crab to eat can be very instructive.

- notice how hard the shell is
- look at how the joints move
- how many sections are there to each leg
- how does the big claw work
- if the crab is whole, explore the complex mouth parts and ask the children how they suppose they work
- as you crack the crab and begin tasting it, look for color on the surface of the meat (red-brown on Dungeness, red-orange on King and Tanner). This is the new shell beginning to form between the meat (muscles) and the old shell. If the crab is close to molting, the new shell may even be thickening and rubbery.
- if you have more than one species for eating, try to taste carefully and see how you would describe the differences in taste and texture of the meat of each.

HERMIT CRABS

Teacher Background

Hermit crabs are animals whose body structure has been modified to enable them to take advantage of the protection afforded by abandoned snail shells or similar objects. The front of the animal looks like that of other crabs - antennae, stalked eyes, jointed legs, exoskeleton covered body. But the animal's abdomen is long, usually curving and soft. On the end of it are special hooks for grasping the internal column of a snail shell.

Like other crustaceans, hermit crabs molt to grow. When they increase in size, it is often necessary for them to move to larger snail shells. When this is the case, the crab locates a new shell to its liking, releases the old shell, and backs into the new one.

On our beaches hermit crabs may be found in tide pools, on sandy stretches, or among cobbles. When picking up snail shells to look at them, you may be surprised to find the opening of the shell filled up by a retreating hermit crab.

ACTIVITIES

In The Classroom

Materials

PAGOO by Holling Clancy Holling, 1957, Houghton Mifflin Company, Boston.

This is a book that deserves many superlatives to describe it. It is the story of one small hermit crab, his life, his trials and tribulations, and his encounters with other sea creatures. The telling of the story is well and delightfully done. The illustrations are lovely, good art, as well as being accurate portrayals of marine plants and animals.

Written about hermit crabs and other aspects of marine life along the California coast, PAGOO describes most of the life forms that occur in our waters, so the information relates directly to what children will encounter here.

The book is 87 pages long and should be read to the class over a period of days or you might read it ahead and retell the story to the class showing them the pictures as you go.

PAGOO is an excellent introduction to hermit crabs but more than that, it is an excellent introduction to everything the children will see on our beaches. It might be used with the class either to teach them about the beach before going there or it could be used as a summary activity after the beach experience.

If PAGOO is read, or told, you might encourage children to do some sort of creative follow-up activity...

- draw a picture of Pagoo in his world
- make up a class story about your own hermit crab
- write a short story about a hermit crab (or other sea creature) and illustrate it

* *

A finger play that might be done...

Words for Song	Accompanying Actions
I am a little hermit crab	- fingers of one hand creep across desk or table.
Looking for a hermit shell.	
I see one...	- cup the opposit hand a short distance in front of the creeping fingers.
Here I come!	
This one suits me very well.	- the creeping fingers jump inside the cupped hand.

* *

At the Beach

Perhaps the most fun comes from discovering a hermit crab tucked inside its shell. When children have found some, an adult can hunker down with them and ask some of the following questions:

- What colors is he?
- What sort of area does he live in?
- What other kinds of animals live there as well?
- Move your hand quickly or slowly. Does the crab react to that kind of movement?
- Cast a shadow over the animal. What does it do?
- Why was the hermit given the name it has?

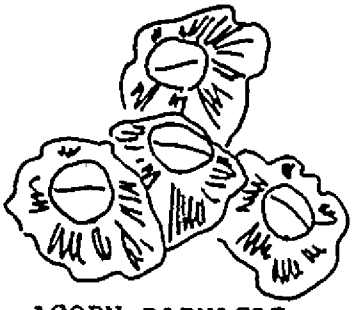
Children usually like to pick up hermit crabs and hold them. Encourage them to place them on their hands and hold very, very still. With luck the hermit will emerge from the shell and crawl over the palm of the child's hand. Also, try putting the crab in a diskpan or other container of seawater, for closer inspection.

* *

If you find a number of hermit crabs, have the children look at them carefully to see if they are all the same kind. If not, ask:

- how are they different from each other?
- are they all living in the same kinds of shells?
- are the shells all the same size?
- are the hermits the same size?

BARNACLES



ACORN BARNACLE

Teacher Background

Young barnacles are free swimming like other crustacean larvae. When they settle to the ocean floor, however, barnacles attach themselves to the substrate by their head region and start to secrete a hard, calcareous sheath around themselves. When the protective cover is complete it is usually conical or columnar and has at the top of it plates that open like a door. Through this opening, the barnacle that lives inside sticks out specially modified legs that rythmically wave through the water, collecting from it bits of food that are pulled into the animal for it to eat.

Several species of barnacles may be found on our beaches. Some are rather large, others always small. If you look carefully, you will notice that different kinds of barnacles tend to grow in different kinds of places or in different beach zones.

ACTIVITIES

At The Beach

Barnacles may be one of the first things to be seen at the beach - small dots of white covering the rocks. Have the children look closer to their volcano shape and see how tightly they are closed. You might ask the following questions:

- What do you suppose could be inside this strange shell?
- If the children know they are barnacles, explain to them how barnacles are similar to other crustaceans - crabs and shrimp and amphipods.
- What advantage is it to the animal to be able to close itself up so tightly in its shell? (Prevents it from drying out when the tide is low and it is exposed.)

Look for barnacles in tide pools where they can be watched feeding. Encourage children to hunker down and watch them. Discuss with them how the animal is feeding and how the soft creature is curled up inside the shell with its head stuck down hard to the rock.

BARNACLE FEEDING

SHRIMP

Teacher Background

Shrimp are not common intertidally here but it is possible that children will find them in tide pools. There are a number of commercial species in Alaska and far more species that are lovely to look at but too tiny to eat.

In general, shrimp are crustaceans that have become modified for both swimming and walking. The forward legs are used for traversing the bottom and the appendages on the animal's tail section are modified for swimming. Shrimp molt like other crustaceans. Members of some species in Alaska have an interesting life history in that they may begin life as males, then later undergo a change and spend the rest of their lives as functional females.

ACTIVITIES
At The Beach

If you find shrimp in tide pools at the beach, encourage the children to watch them and perhaps ask some of the following questions:

- how does a shrimp look like a crab? how does it look different?
- what color is it? is there any advantage to the shrimp in being that color?
- how does the shrimp move and in what directions? which legs does it use?
- watch its antennae. what are they doing? what do you suppose they can tell the shrimp?

If you find shrimp, you might catch a few if you can and put them in a bucket of salt water so the children can watch them move in that environment.

- does it swim? how?
- what appendages does it use?
- how does it use its tail?

Notice how it swims slowly forward when not excited but darts rapidly backward when frightened.

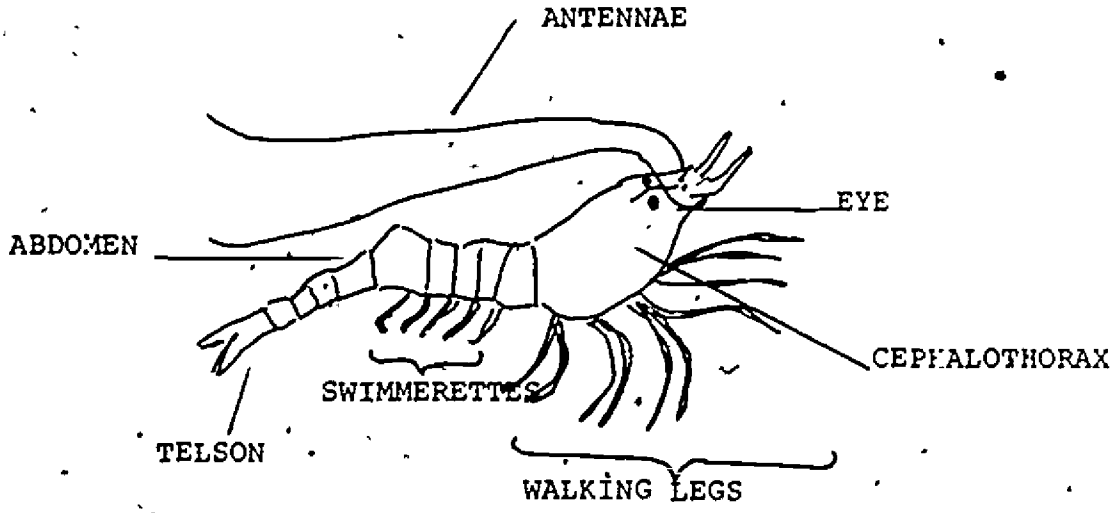
AMPHIPODS

Teacher Background

Amphipods are the street cleaners, the garbage collectors of the marine environment. They may be nearly everywhere - from open ocean to under intertidal rocks. When food is available such as bait in a crab pot or a dead fish lying on the sea floor, they may congregate in great numbers and in spite of their small size, soon strip the food source to its naked bones.

At The Beach

Sometimes called beach hoppers or sand fleas, these small animals may well be found by the children during the field trip to the beach. They are so wiggly that trying to catch them can be fun. Children may also enjoy watching and feeling them wiggle in their hands. If someone has a magnifying glass the children might be able to see the two kinds of legs on the animal that are the reason for its name.



WHAT IS A MOLLUSK?

IN THE CLASSROOM

Materials

.Poster - showing the wide range of animals in this classification
Shells
1 Filmstrip

Procedure

As with all major groups of marine animals, some information must come to the students directly from the teacher. However, a certain element of "discovery" may also be utilized. For instance, students may be encouraged to look at a wide diversity of molluscs either through handling actual shells and other materials or looking at filmstrip materials, posters, or pictures that have been collected from printed material sources.

Mollusks include such diverse animals as:

1. bivalves - clams, mussels, cockles, etc. - animals with two halves to their shells.
2. chitons - the flattened animals with numerous plates forming the armour on their backs.
3. limpets - commonly called china hats by the children because of their similarity in shape to the hats worn by Chinese farmers.
4. gastropods or snails

Children can realize that all these animals have some kind of hard shell covering their bodies. This is a key characteristic of most members of the group Mollusca.

Discussion can lead them to recognize the wide variety of forms, sizes and colors that these shells take:

1. some consist of two halves (bivalves)
2. some of several plates that fit closely together (chitons)
3. some are conical (limpets)
4. some are spiraled (snails)

If you are working from materials that allow it, you might lead the children to recognize another identifying characteristic of molluscs:

> their muscular foot which is used for moving over the substrate.

Each mollusk has only one foot - not two like we have- and if the animal is turned over with his shell side down, it is the muscular foot that can be seen and felt on its underside. Bivalves have a foot too but it is modified for digging into soft sand or mud and is retractable into the animal's shell so it is less readily seen. The mollusk foot of many species is edible and many Alaskans enjoy eating the feet of local snails, chitons, and even limpets. In the highly prized mollusk, the abalone, it is also the foot of the animal that is eaten.

Some mollusks are sneaky and do not have shells because at some point in their very long histories they have lost them or in other ways become modified in their development. The two groups of such animals that children either already know or can easily become familiar with are the cephalopods (octopus and squid) and nudibranchs.

Cephalopods

Cephalopods are the most intelligent of mollusks, with well-develope heads and large brains. They are quick and active. Their eyes are very similar to our own. Most children are familiar with the octopus' eight armed shape and with its ability to jet through the water by using its siphon to expel a powerful jet of water. In spite of the awesome reputation, octopuses are not the dangerous animals they are generally construed to be. For the most part, they live reclusively in dens, leaving home only in search of food. Their food most often is other molluscs (such as clams) or crustaceans (the crab-like animals). Squid are probably less famil to students. They have two additional tentacles and often are seer darting through the water in schools. Both octopus and squid are found in Alaskan waters but only octopus are occasionally found intertidally in dens under large boulders so children will seldom have an opportunity to observe them first hand. Occasionally there is an octopus in the salt water tank at the Auke Bay NMFS laborato Like many other mollusks, both octopus and squid are considered excellent eating.

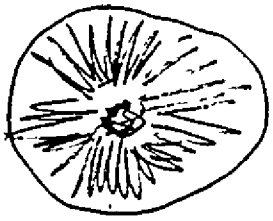
Nudibranchs

Nudibranchs, or sea slugs, unlike cephalopods, may be found intertidally on our beaches. They are some of the loveliest and most bizarre of the mollusks. Basically, they are snails without shells...naked animals that have developed elaborate naked gill structures and striking color patterns and variations in body appearance. They range in size from a fraction of an inch to more than a foot in length - but the intertidal ones are all small. They move on a foot as do snails and most other mollusks, slowly traversing their part of the ocean floor in search of food.

If you can find visual materials showing a vareity of nudibranchs, your students (and you) will be impressed with their beauty, delicacy, and lovely coloration. Most commonly found intertidally here is a small nudibranch that is delicately colored with shades of pink and has on its back many white or pink tipped cerata, or pointed, finger-like, soft projections. You might alert children to their presence on the beach and encourage them to watch in tiny pockets of water for these small, special animals.

NUDIBRANCH

LIMPET



AT THE BEACH

Materials

buckets
pans
shovel

Procedure

The single most exciting element of any beach outing is simply that of discovering what is there - and it is true for everyone whether first grader, teacher, or parent helper. One of the major elements to be seen - discovered - on the beach are the mollusks.

Ask the children to see how many different kinds of mollusks they can find. Encourage them to look in many different areas of the beach - at the level of the water and at varying distances upward away from the water, at areas of bedrock, cobbles, sand, and mud. Each of these areas will be populated by different kinds of mollusks. Encourage them to try to remember where they find what:

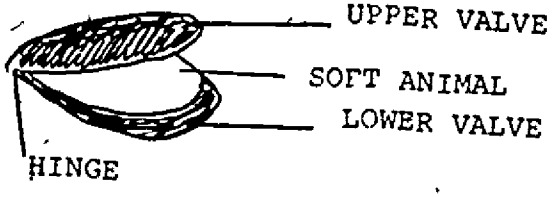
1. tiny periwinkles are to be found on rocks well above low tide level.
2. mussels cling tightly to rocks with tiny threads that are laid down by a gland in their foot.
3. larger kinds of snails will be found close to the water's edge.
4. limpets and chitons cling tightly to rocks and may increase in numbers with greater proximity to the water.
5. clams and cockles lie exposed or buried on or in sand or mud.

Be sure that someone in the group has a shovel and is prepared to show clams or cockles. Children will enjoy searching for the small holes in the sand that indicate their presence, a presence often given away when the animal ejects water from its siphon sending up a spout of water which may even catch someone unaware and give him or her a surprise mini-shower.

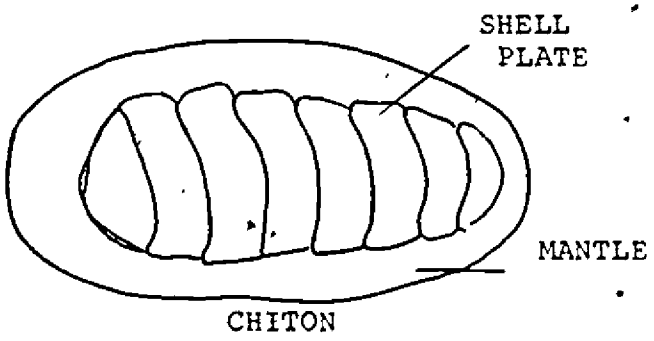
If you can sneak up on a sizable buried bivalve, you can point out to children that it has actually two tiny holes in the part that extends to or above the level of the sand's surface - one of these is an incurrent opening, the other excurrent. The animal feeds

by continually circulating water through its internal parts and straining out of that water tiny food particles. An adult - or responsible student - should try digging out some of these buried bivalve mollusks.

After children have had a chance to see the clam, be sure that it is reburied or thrown out into the water so that it is not killed just to satisfy a momentary curiosity.



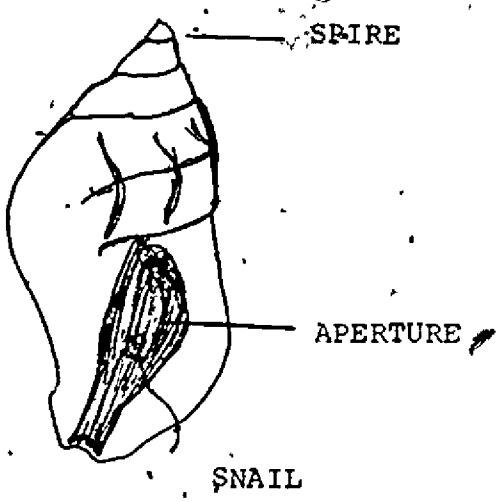
BIVALVE



When examining snails on the beach, children might have someone point out to them that each snail has a door called an operculum which it can use to seal itself off from the world as a defense against a larger animal that would eat it or as protection from drying out if it is out of the water for a long period of time. If a snail is picked up, its usual reaction is to pull its foot back inside its shell and to seal off the opening with the operculum.

If you wish, at the beach, a parent helper might be given the responsibility of collecting - with the children's help - a variety of kinds of mollusks. After a period of discovery, exploration of the beach, students might be gathered into groups to discuss the kinds of mollusks that have been gathered. Children should be able to put simple labels on them:

- snail
- chiton
- clam.
- limpet
- nudibranch
- cockle



They might also enjoy watching a group of snails placed in a pan of cold sea water, noting how they travel on their extended feet and how their antennae, or feelers, are constantly active, taking signals from the environment and helping the animal look for food. A bucket might also be partially filled with sand or mud, topped off with sea water. Then, if a clam or cockle is placed on top of the sand or mud in the bucket, with luck, children could watch it extend its foot and burrow down into the protective bottom.

If a specific project with shells has been planned by the teacher, EMPTY shells to be used in that project might be collected during the beach trip. If this is done, each child might be asked to find and keep - or give to an appointed adult - a specific number and/or kind of shells.

FOLLOW-UP ACTIVITIES
(in the classroom)

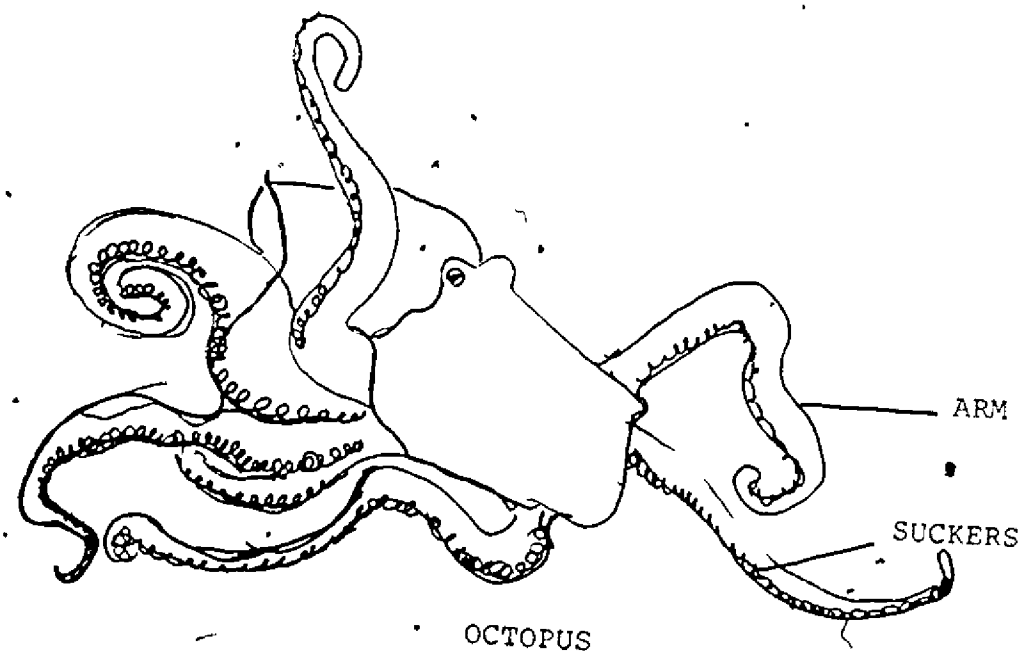
Any number of projects can be done at a first grade level with empty beach shells. Art projects may include the making of:

- mobiles
- collages
- sand and shell pictures
- making of figures
- etc.

Many idea sources available to teachers carry specific suggestions for projects that may be undertaken. If you elect to undertake such a project, it is important that you make a list of your raw material needs before going to the beach so that you may bring back whatever shells you need.

Other activities might involve shells in arithmetic problems or in studies involving comparisons - for instance, categorizing shells into groups of different sizes, colors, types, etc.

Because mollusks, like all other marine animals, cannot live long out of salt water of the particular concentration and temperature to which they are accustomed, it is not advised that any classroom activities be planned with live specimens unless a functioning salt water aquarium is available for maintaining the animals or unless the teacher has a valued friend or conspirator who is willing to gather materials, bring them to the classroom, then quickly whisk them back to the beach environment. Some live materials (i.e., clams, snails) may be kept in paper towels dampened with sea water and placed under refrigeration for perhaps as much as 48 hours but observations of the animal's true behavior is difficult unless well-oxygenated sea water at a proper temperature can also be at hand as an environment for the animals. Classrooms are just too warm for most marine creatures - even if they can tolerate being out of water for periods of several hours.



OCTOPUS

STARFISH, SEA URCHINS, BRITTLE STARS AND SEA CUCUMBERS
(Echinoderms)

Teacher Background

Echinoderms are spiny skinned animals. Although such animals as sea cucumbers and brittle stars at first seem to have little in common, careful observation and thought will reveal their similarities. All members of the group are radially symmetrical and most frequently can be divided into five equal wedges. This is easy to see on the stars and urchins, but when looking at a cucumber, one must first realize that the animal is, in effect, lying on its side and that the symmetry is therefore longitudinal instead of vertical. Members of this group also all have tube feet, the tiny, suction-cup tipped extensions that enable the animals to move, cling to surfaces, and in the case of starfish, pull open food such as clams.

* * * * * * * * * * * * * * * * * *
* WHAT IS A STARFISH? *
* * * * * * * * * * * * * * * * * *

IN THE CLASSROOM

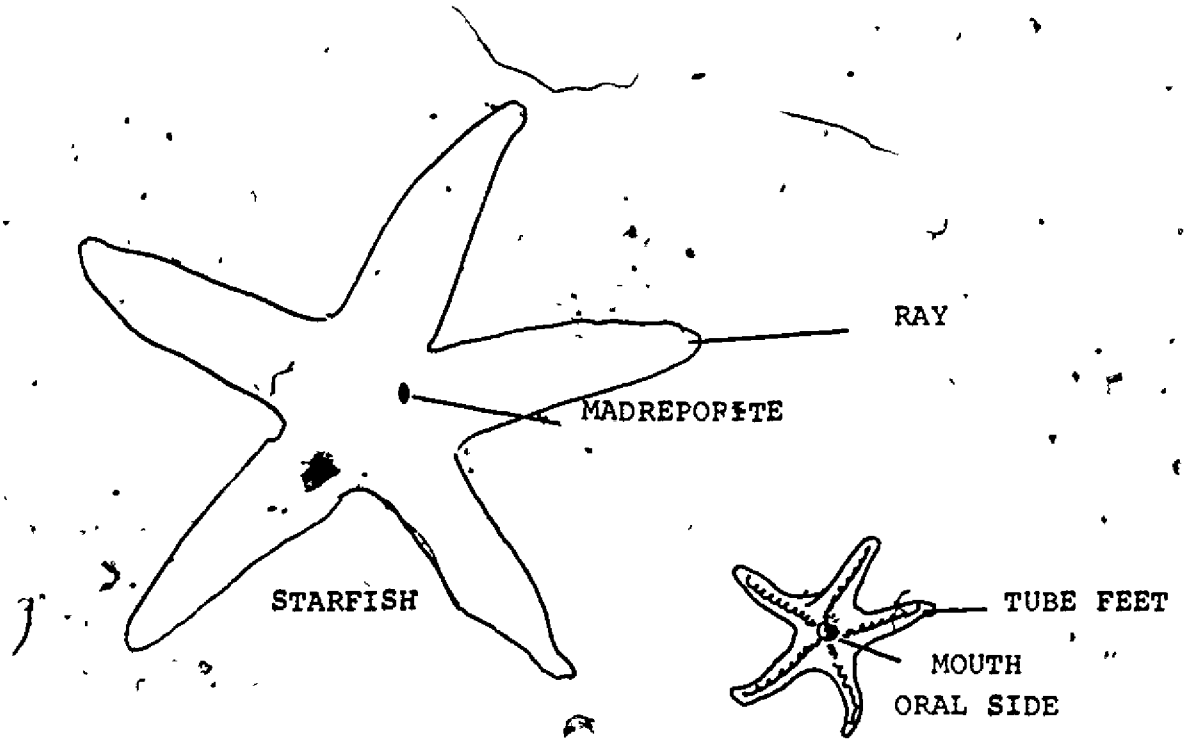
Materials

starfish or sea star
a pan or other place to put the animal
magnifying glass
suction cup

Procedure

Statement: This portion of study of the starfish is understanding the anatomy of the starfish or sea star.

Sea stars are one of the obvious, relatively abundant animals on our beaches. It should, therefore, not be very difficult to obtain one for class study before the beach experience. You might collect one or two yourself or ask a parent who lives along the beach to bring one in for you on an appropriate day. Any sea stars you collect intertidally will be those accustomed to occasionally spending time out of the water and exposed to air so they should survive a short stint in the classroom. Keep the animal in a moist situation (perhaps in a cloth bag dampened with sea water) in a refrigerator or outside in a shady spot until you want to use it with the children. Keep it away from its natural habitat as short a time as possible and return it to the beach when you are done.



For demonstration purposes in the classroom, any sea star found on the beach will do. Some of them, however, may prove less desirable than others so you may want to avoid those which exude large quantities of mucus or those that seem relatively soft and flacid. The common five-rayed star, Evasterias trochelli, is stiff, but relatively durable and the several species of sun star would also serve well. If the beach seems devoid of stars, you might look under cobbles or small boulders well down on the beach in hopes of finding the small, green, six-rayed Leptasterias hexactis that often live in that habitat. Females of this species plucked from the underside of rocks will, in the spring, often have beneath their bodies a cluster of yellow-orange eggs that they are brooding.

In the classroom have the students look carefully at the starfish. Ask them to:

1. count its rays,
2. feel the texture of it (every species feels different)
3. see if they can find its mouth
4. feel the soft, closed tube-like structures that crowd into the groove that runs the length of each ray on the animal's lower (or oral) side

Ask the class: What might tube feet help the sea star do?

Look in the mouth area and in the adjacent grooves for the commensal worms that sometimes live there, doing no harm to the star but profiting from the friendship - probably by having easier food gathering.

How do tube feet work? Tube feet are for walking. Using a suction cup, you can explain how a star can extend its tube feet, stick them to a surface, then by contracting the tube feet, pull its body toward the adhering feet. Some species of sea stars often feed on clams and other bivalves and with their tube feet they can apply a steady pulling pressure to both halves of the bivalve's shell and eventually cause the mollusc's muscles to relax, the shell to open, and dinner to be available.

In looking closely at the star, children may also notice: (1) a tiny red dot at the end of each ray (an "eye spot" with limited sensory reception); and (2) a hard, relatively smooth spot on the top (aboral) center surface of the star (the madreporite, or external opening into the water-vascular system to which all the tube feet are linked). Through the madreporite water enters and leaves the system so that pressure can be maintained; and, (3) soft "fuzz" on the upper surface. This fuzz is actually the papillae, tiny structures for respiratory exchange.

Be sure to have a hand lense at hand so that students can look closely at:

- the tube feet
- the texture of the back of the star
- any other parts of interest

AT THE BEACH

Materials

a ruler
an adult with a clipboard or notebook for writing down the children's observations

Procedure

Statement: This portion of study of the starfish will answer the questions of: (1) how big are they?, (2) what stars are there?, (3) where do they live?

Ask children to think about starfish as they explore the beach in terms of: (1) how many kinds of starfish can you find? (2) where do you find each of them? (3) what color or colors is each different kind?

Typically on our beaches they will find the following:

1. the large six-rayed Evasterias trochelli which is always of one color but that color may be any shade - purple, orange, green or duller colors.

2. the very large sunflower star, Pycnopodia helianthoides, which has as many as 24 rays, is soft and fragile and may be pink, orange, purple, or a combination of these colors.

3. the rose star, Crossaster papposus, which has a very "textured" aboral surface, usually ten rays, and is patterned in circling bands of rosy pink or red with white also occurring.

4. the blood star, Henricia leviuscula, which is easily identified by its bright orange-red color and its five very slender rays.

5. three species of sun stars, Solaster, which can be difficult to tell apart but all of them have numerous rays, are medium on a hard-soft scale, and are often some shade of red or purple.

All of the stars mentioned above will be found exposed on sandy or sand-cobble areas. If the children look under rocks they will also find the small six-rayed star, Leptasterias hexactis.

Perhaps an adult helper specializing in sea stars for the day could help the children realize that the number of rays is different on different species and so is the color pattern.

Measuring starfish. the helper might also involve the children in measuring sea stars asking such questions as:

1. What is the best way to measure one? (usually done as a total diameter and sometimes also including an additional measurement of the length of the ray. Children might decide on a universal hand measure - one hand wide, one and a half hands wide, etc.

2. Which stars are largest?

3. Which are smallest?

4. Are most stars of the same kind about the same size?

When notes have been made, children may want to draw some conclusions about the variety of sea stars that can be found on the beach. They might also discuss which ones were found where.

Follow-Up Activities

If no live sea stars were examined at close range in the classroom before the beach excursion, you might want to take back one or two to the classroom with you to look at that or the following day. If so, follow the procedure already outlined in IN THE CLASSROOM.

As a good test of memory, you might ask children to make pictures of all the different kinds of starfish they saw at the beach or ask each one to draw a picture of his favorite sea star. These could be for taking home or might make an attractive bulletin board if cut out and pinned to the wall.

WHAT IS A BRITTLE STAR?

It is unlikely that students will encounter brittle stars during their field trip to the beach but just in case and because they are animals students may already know something about, included here will be a bit of background about the animals.

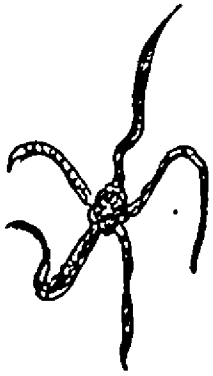
The relationship of brittle stars to sea stars is quickly apparent. They have the same kind of star shape - a central disc from which extend the rays - usually five. They have tube feet and a central mouth on the lower side of the animal.

Brittle stars, however, have rays that are snakelike and are usually capable of moving sideways in a manner similar to that of a snake. Their rays are always long and slender and the animal itself feels hard, never soft as do many of the sea stars.

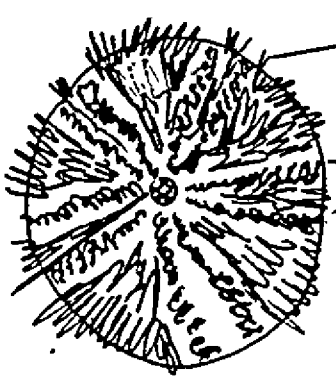
Both sea stars and brittle stars have strong regenerative powers, being capable of regrowing a ray if it is severed. Many can even regrow an entire individual from one ray and the adjoining piece of the central disc. Among brittle stars, self-mutilation is common. If the brittle star is handled or threatened, it may readily shed terminal parts of one or more rays. The lost parts will, in time, be regrown to original size. If brittle stars are examined, abrupt changes in coloration on the rays can be seen. These mark places where a break has occurred.

Brittle stars are generally secretive, often hiding under rocks, among kelp holdfasts or in other similarly sheltering places. Many species seem to be nocturnal, hiding by day and emerging at night to feed on detritus and other food bits they may encounter.

One unique brittle star that occasionally washes ashore on local beaches in the basket star, Gorgonocephalus eucnemis. It has a basic five rays but these branch again and again until the animal looks like the mythological Gorgon's head with its writhing snakes in place of hair. The basket star is usually flesh colored, lives sub-tidally and feeds by anchoring some of its tendrils to the substrate while extending others into the water's current to strain from it tiny, drifting organisms or other material that will serve as food.



BRITTLE STAR



SEA URCHIN

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* WHAT IS A SEA URCHIN? *
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Teacher Background

There are several species of sea urchin that may be found in intertidal or shallow waters in Alaska but only one of them, the green urchin, Strongylocentrotus droebachiensis, may be expected to be found on local beaches. It looks like a pincushion covered with green pins or needles and can be easily recognized by all the children.

IN THE CLASSROOM

Materials

a live sea urchin and an urchin test
a container to place it in
a magnifying glass

Procedure

Like starfish, sea urchins can tolerate a certain amount of out-of-water time. They, therefore, are good candidates for classroom observations. Collect a few of them from the beach and keep them damp (by sea water) and cool until you are ready to use them the same or the next day.

Place them in a pan and give the children the chance to observe, touch, hold them. The following questions might lead to good discussions:

QUESTION: How is the urchin like a starfish?
ANSWER: Both have tube feet, both are radially symmetrical and can be divided into five wedges though this is hard to see in a living animal.

QUESTION: Where are the tube feet?
ANSWER: Extending out of pores all over its body.

QUESTION: What would tube feet do for the animal?
ANSWER: They are its feet.

QUESTION: Where is its mouth?
ANSWER: In the middle of its "down" side.

QUESTION: What do you suppose it eats?
ANSWER: Its teeth are made for scraping/biting algae and detritus off hard surfaces such as rocks.

QUESTION: What good does it do for the urchin to have all those spines?
ANSWER: They protect the animal from some predators.

Having an urchin test (or internal "shell") at hand at the same time that you are studying the live urchin will enable you to show the children more about the total animal. Ask the students to look at both the living urchin and its test, then discuss the following questions with them:

QUESTION: What does the test do for the animal? What part of him is it?
ANSWER: It is his skeletal support, protecting internal organs and giving the animal shape.

QUESTIONL What do you suppose the bumps and holes on the test are for?
ANSWER: The conical bumps are knobs upon which the spines articulate; the holes are openings through which the tube feet extend.

QUESTION: Where on the test would the animal's mouth be?
ANSWER: If the mouth parts are present, look at them closely to note the many, intricate, articulating parts. This complex mouth structure is called Artistotle's lantern.

The top of the test may have a hole in the center of it or this space may be filled with plates different from those on the rest of the animal. This area is the madreporite - the same part that can be seen on the surface of starfish - and serves to let sea water in and out of the system of tube feet.

The test is made up of a definite pattern of holes and bumps. Ask students how many similar pie-type wedges they could divide the test into and have all the wedges be the same. By looking carefully, they will see that there are five distinct sections - comparable to the five sections that typify many species of starfish, their close relatives.

AT THE BEACH

There is not a great deal to do with sea urchins, other than to have the children be sure they recognize them when they see them. You are apt to find them in tight concentrations of several to many individuals resting close to one another. This kind of grouping typically occurs during the spring months, the time when urchins reproduce by releasing eggs or sperm into the water. The chances of producing a greater number of offspring are enhanced if the spawning adults get together for the occasion!

WHAT IS A SEA CUCUMBER?

Teacher Background

Sea cucumbers, as relatives to sea stars, sea urchins, and brittle stars, share with these relatives a pattern of radial symmetry and the possession of tube feet. The skeletal material of a sea cucumber, however, has been reduced to small "buttons" embedded in its skin. Thus the general appearances of the animal is soft and "squishy".

There are a number of species of cucumber in Alaskan waters:

1. the large Parastichopus californicus, a species that frequently measures more than a foot in length and whose thin layer of muscles under the skin are very delicious eating. On some beaches it may be found on exceptionally low tides.

2. most apt to be found intertidally on our beaches is the tiny black species, Cucumaria vegae, that lives among rocks and cobbles.

3. also intertidally is the white species, Eupentacta quinquesimita, which may be two or three inches in length.

IN THE CLASSROOM

Sea cucumbers out of water and away from their habitat don't look like very much so it is probably best to leave close up examination of them for a beach activity. DO, however, show the children pictures of these animals before they go to the beach so that they will recognize them when they encounter them near the water's edge.

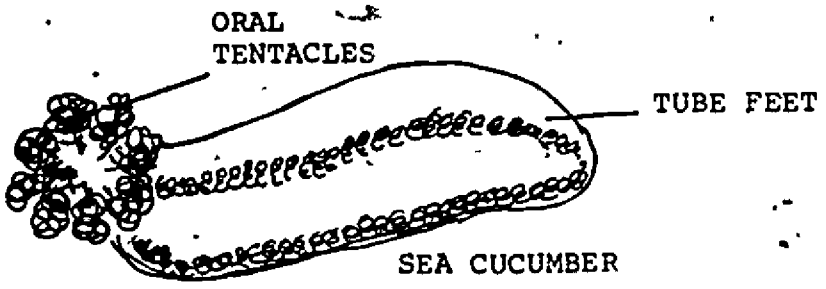
AT THE BEACH

Materials

a sea cucumber
a magnifying glass

Procedure

Perhaps an adult helper could be in charge of keeping an eye out for cucumbers. When someone finds some, it is best not to touch or otherwise disturb them but rather to sit quietly and just look. If the animal is in a tide pool, it is possible to see it searching



for food by extending its frilly oral tentacles. With these it gathers bits of food and pulls them in toward the mouth. After just observing them for awhile, children might look closely at them with a magnifying glass, looking at the texture of the skin and for the longitudinal rows of tube feet.

Follow-up Activities

Sea cucumbers are one of a number of local intertidal animals that are quite edible and tasty. If you yourself are into eating wild foods or if some of your children's parents are, consider the possibility of either having a session in which your students help prepare some wild food for eating or arrange with some of the parents to have some of the locally available wild foods brought in for the children to sample. Great if you could combine this with some studies in the classroom of Tlingit culture and persuade some parents who are Tlingit to share some of their traditional foods with the class including algae and marine invertebrates, of course!

IN THE CLASSROOM

Materials

chart
ditto sheets — of the anatomy of a typical fish
chalk drawing
aquarium - if available this would be great for letting children observe first hand how a fish moves and breathes and feeds.
one fish - whole and frozen (until needed in the classroom)

Procedure

HOW DOES A FISH BREATHE?

If a specimen is available, have the children examine at the gills. A fish draws water in through its mouth and expells it through its gills. As water passes over (and through) the complex gill structure, oxygen is removed from it and passes into the fish's body to keep it alive.

If there is no fish for them to handle, look at the gill slit on the fish in the aquarium or on the chart or ditto sheet.

HOW DOES A FISH MOVE?

Have the children put their hands in the middle of their backs and ask: What do you feel there?

Backbones are important for holding our bodies erect and giving them shape. Fish have backbones too just as we do. If you can, bring in fish bones for the children to see or - if you are not squeamish - cut along the back of the whole fish you brought in to reveal the backbone.

Watch a fish in an aquarium (or film) to see how it moves. The tail moves rapidly from side to side like a paddle to push the fish forward.

One of the small wind-up bath tub fish could be used in a pan of water to demonstrate this movement.

Show how fins may be collapsed or held erect as the fish uses them to propel or steer itself.

Not all fish have scales but on those that do, scales help protect the skin and give a smooth surface to the body to reduce resistance as the creature moves through the water.

HOW DOES A FISH SURVIVE?

The sea is full of hungry creatures always looking for a good fish dinner (larger fish, seals, sea lions). Ask the children: How might a fish protect itself from something that would eat it (a predator)?

1. ability to swim away rapidly is, of course, a primiary means of defense.

2. some fish (like sculpins) have spines that are part of their defense.

3. some (again like sculpins) have coloration that blends perfectly with the kinds of sea plants or animals among which they nestle.

4. flatfish spend most of their time resting on sand or silt bottoms and usually they flick their tails to shower silt over themselves and thus hide.

HOW CAN A FISH BE ADAPTED TO A SPECIFIC PART OF THE MARINE WORLD?

Each part of the marine environment is populated with fish specifically adapted to it.

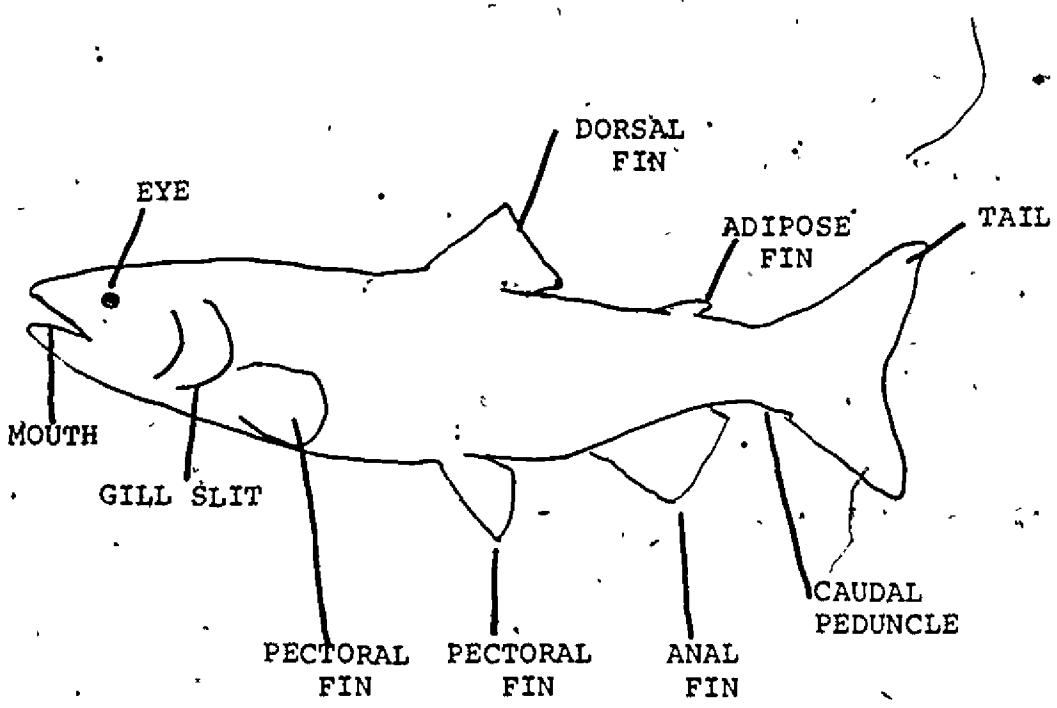
1. salt water/fresh water: salmon eggs hatch in fresh water. The young travel down streams to salt water where they live and mature. Adults return to fresh water, to the exact stream where they were hatched, to lay their eggs and die.

2. open waters: some fish are always swimming, never coming to rest on the bottom. Salmon are among these when they are in salt water.

3. sand or mud: here the flat fish can blend so well with the bottom that they go unnoticed.

4. rocky areas: rock fish are found here. Also, blennies, and small sculpins can be found intertidally.

Ask the children to think about where on the beach they might be most apt to find live fish. (In tide pools or under rocks where it is moist even if the tide is out.)



AT THE BEACH

Materials

bucket

Procedure

Encourage the children to look for fish and to recognize different kinds that they find. Ask them to remember where they find the fish. In all probability, they will find:

1. blennies (long, slender fish) under rocks or possibly in tide pools.

2. tiny sculpins (broad, flattened fore part with protective spines on back and broad mouth, thin tapered tail section) which are usually in tide pools.

One bucket taken to the beach might be reserved just for fish and two or three blennies and an equal number of sculpins might be placed in it when it is partly filled with sea water. Have the children watch how the fish swims. Put some stones in the bucket and watch to see if the behavior of the fish changes. What do they do? (be sure to return the fish to the sea after the children have had a chance to watch the fish swim, and hide and to look at its fins, mouth, gill slit, and eye.)

FOLLOW-UP ACTIVITIES

Fish Prints

These could be done before the beach experience, too, but they might serve as a good review of what a fish is. They could be used with class thank-yous to people involved with the class in sea activities or might make good presents to parents as a way for the child to share his sea experience with those at home.

Materials

Any whole, fresh or frozen fish although flat fish probably work best of all. Length should be at least six inches or so. If the fish is kept frozen until ready to use, be sure to thaw it well before trying to make prints with it.
Printing ink
Brayer
Glass or board upon which to roll an ink brayer
Paper - any paper will do but the better the quality the better the print will be. Rice paper is THE best.

Procedure

1. Squeeze a bit of ink on the glass or board. Roll the brayer back and forth on it to ink the brayer. Then roll the brayer all over the surface of the fish to ink it.

2. Take a piece of paper that has been already cut to proper size. Place it carefully atop the fish. Then rub gently but firmly. Be careful not to let the paper slip or slide.

3. Carefully remove the paper. Be sure the child's name is on it (best if he/she has put the name on the back side before making the print). Put the print out to dry.

4. Later the prints can be mounted on stiffer board, glued on the front of a scrapbook, etc.

Printing often reveals paterns in the scales and other details of the fish that may even be difficult to see with the naked eye so have the children look carefully at what they have printed.

MARINE MAMMALS

Marine mammals are an exciting and important part of sea life in Alaska. Some of the more common marine mammals in Southeast Alaska - humpback whales, harbor porpoises, killer whales, sea lions, and harbor seals - may well be sighted during trips to the beach during Sea Week. Because of this possibility and because children will probably see them on other outings to the beach, it is important to discuss them in the classroom. The activities that can be carried out concerning them, however, are in some ways limited because they are creatures we always see at a distance and cannot collect to look at close-up. But this does not rule out the fun of reading about them, drawing pictures of them, or writing poems or stories about them.

Let it suffice here to give a few quick notes about each of the common local marine mammals and hope that this commentary can serve to start some classroom discussion about them. More detailed discussions of Alaskan species are available in any number of books and current periodicals. Of use in the classroom, too, might be the NOAA poster of marine mammals and a recording, Song of the Humpback Whale, which has captured the intensely beautiful and varying sounds make by that animal in its own world.

Humpback Whales

The largest of our common local marine mammals, humpbacks, are also the whales most commonly seen in the Juneau area. They grow to be about 50 feet in length, have long pectoral limbs and a small dorsal fin set well back on the body.

Because of the immense size of these whales and because they do not often come particularly close to our shores, usually we see only parts of them and then only at a distance. Nevertheless, they are relatively easy to identify.

Watch first for the whale's spout, a white vapor column ascending upward from the water's surface. This spout is caused by condensing vapor as air escapes from the blowhole on the top of the whale's head as the animal surfaces and breathes. Whales in our area may be seen in many patterns of behavior, but most commonly if a whale spout is sighted and the observor continues to watch, he will see the whale spout several times at intervals. Then, quite frequently, the whale will sound or dive deeply. As a humpback sounds, it raises its flukes into the air, and the last thing one sees of the whale is its tail disappearing at it slides down vertically into the water.

Other behavior patterns can be frequently seen, too. Sometimes humpbacks slap the water with their forelimbs. Sometimes they lob-tail, slapping their flukes against the water's surface. Most spectacular of all, however, is to watch a humpback jump, rising headfirst and nearly vertical out of the water, lifting most of its body length clear, then twisting and falling back to the water with a tremendous splash.

Humpbacks are baleen whales. That is, instead of teeth, a humpback has plates of baleen hanging from the roof of its mouth. The baleen plates are frilled along their length and it is this frilled edge that strains out the small marine animals upon which the whale feeds. When it feeds, a humpback whale opens its mouth, takes in a mouthful of sea water and fish or crustaceans, then closes its mouth, forcing out the water but retaining the food. Particularly exciting to watch is a humpback when it is herding feed into a tight ball to make getting dinner easier. When the whale is behaving in this manner, one sees at the water's surface first a few bubbles, then more and more as a circle of them is drawn by the whale which is on the outside of the circle. Apparently, the bubbles disturb or alarm the prey which then concentrate inside the ephemeral fence. Next to be seen is the head of the whale as the animal breaks the surface inside the circle and takes a mouthful of the prey and squeezes out the water.

Killer Whales

The appearance of the killer whale is unmistakable. They grow to about 30 feet in length and are predominantly black. But they are white on their bellies and part way up their sides. There is a white spot behind the eye. Even without seeing the animal's coloration, however, one can identify a killer whale by its high dorsal fin. The height of this fin differs with the sex of the animal and its age. The highest fins are to be found on mature males and may look for all the world like tall, black sails.

Killer whales are most frequently seen in the Juneau area during the summer months. They usually travel in groups of a few to several dozen members. These groups are not necessarily tight, however, and individual members of a group may be spread out over a mile or more.

Known as predatory hunters, killer whales feed on seals, sea lions, fish, birds, and even other whales.

Harbor Porposes, Dall Porpoises

These animals are common in the Juneau area during the summer. They are small animals - up to about 6 feet in length - and almost invariably are seen as a small black fin representing the animal as it surfaces to breathe. Although their speed and

tendency to spend time on the surface increases with feeding activity, they are perhaps more notable to the surface observer for their constancy of pace and behavior.

Harbor porpoises are to be found near shores and in bays. In more open waters, such as Lynn Canal, one may encounter a different species, the Dall porpoise. These animals are vividly marked in black and white and are about the same size of the Harbor porpoise. Their behavior is markedly different from that of the more steady Harbor porpoise. Dalls frequently slash through the water at great speed and will "play" with a boat, running ahead of it and playing in the bow wake.

Steller Sea Lion

North of Juneau at Benjamin Island is a Steller Sea Lion haul out that is used by these animals each year from fall to early summer when they move out of the area and away to rookeries where mating and pupping take place. Thus Steller Sea Lions are to be seen commonly in Juneau waters during the colder months.

Steller Sea Lions are enormous and impressive. Mature males may be 10 feet long and weigh 2000 pounds. Females are smaller. These animals spend a considerable amount of time hauled out on rocks, often well above the water's edge and on land they are cumbersome, awkward creatures. In the water, however, they are grace personified, flying through the water with powerful strokes of their long forelimbs.

During the winter months, sea lions may sometimes be seen in large numbers, especially in Auke Bay where they may congregate when herring are available there as food. Whether they are in groups or solitary, the behavior and appearance of the sea lion will quickly distinguish it from the Harbor seal, an animal with which it is sometimes confused.

The coat of the sea lion is brown. The shape of its head is generally pointed, except on large males which have a more pronounced downward breaking of the line across the brow. Sea lions have external ears.

Sea lions are often flamboyant, raucous animals. When they are traveling, again and again they will push their noses above the surface to breathe, then arch their backs which show above the water's surface as the animal disappears, only to surface again a short distance further on. When two sea lions meet going in opposite directions, it is common for them to surface, heads together, and nuzzle each other before continuing on their separate ways. Sometimes sea lions may be seen, heads above the water and shaking a fish or octopus violently to tear it into pieces small enough to swallow. At other times, they seem to lift their heads out of the water just out of curiosity as a boat passes or something else happens at the surface that seems to interest them.

Harbor Seal

These are shy animals, about five feet long, and covered by a coat whose extremely variable markings may include shades of brown, black, silver, and gray. They have no external ears and their snouts seem to end more abruptly than those of the sea lion, thus giving their heads a rounded, blunt shape.

Harbor seals are common in the Juneau area but sometimes one must look quickly to see them. Typically, one sees only an expanse of water. Then a head pops straight up, swivels as the animal looks around, then disappears leaving only a small disturbance in the water and the observer to wonder if he really did see an animal there.

Like sea lions, Harbor seals leave the water and spend periods of time hauled out on shore, frequently on small islands or other similarly undisturbed places. Harbor seals, however, do not venture as far out or above the water as sea lions do, preferring to be near water level and close to it so that they can quickly slip away from the rocks.

UNIT EVALUATION

Although no forms are included here for use in evaluating the effectiveness of your studies of marine animals, several approaches can be suggested:

1. You might ask the students to draw a picture of a number of marine animals you have studied. For instance, say to them, "draw a picture of a starfish and write its name under it." Then write STARFISH on the board. Allow an interval, then ask them to draw another animal.

2. Give them a sheet which you have divided into boxes and on which each box is labeled with the name of one kind of beach animal. Ask them to draw a picture of each kind of animal.

3. Make up a ditto sheet for matching pictures of common animals with their names.

4. Make a ditto sheet showing the beach and ask children to draw in what animals they would find where on the beach.

5. Make up a sheet with simple statements for the students to complete. For example, "I live in a shell that once belonged to a snail. I am a _____."

ANNOTATED BIBLIOGRAPHY

The following books will be valuable sources of additional information:

Flora, Charles J. and Eugene Fairbanks. 1966. The Sound and The Sea. Pioneer Printing Co., Bellingham, Washington. xii + 455 pp.

This books is a (generally accurate) phylym by phylum account of marine invertebrate species commonly found in the Washington State-Puget Sound area. Includes photographs of each species described.

Curriculum Research and Development Group - University of Hawaii. 1976. Reef and Shore - Hawaii Nature Study Program for Elementary School Children. Teacher's Guide. University of Hawaii, 1776 University Avenue, Honolulu, Hawaii. ii + 265 pp.

This is an excellent study guide - and one which served as a model in the writing of this material. The specific animals in Hawaii are different from those found in Alaska, but the ideas and approaches contained in this volume are valuable and can easily be applied to Alaskan shores.

Johnson, M.E. and H.J. Snook. 1927. Seashore Animals of the Pacific Coast. Dover edition (1967). New York, New York. 659 pp.

A good general description of each phylogenetic group and its characteristics, as well as some specific information on particular species. Written primarily about California and Northwest species but most apply here, too.

Kozloff, Eugene N.. 1974. Keys to the Marine Invertebrates of Puget Sound, the San Juan Archipelago, and Adjacent Regions. University of Washington Press. Seattle and London. 266 pp.

The only technical key available for identifying invertebrate species of the Northwest. Most species included in the keys also occur here. Good for putting scientific names on specific animals.

MacGinities, G.E. and N. MacGinities. 1968. Natural History of Marine Animals. 2nd Edition. McGraw-Hill. N.Y. 523 pp.

A discussion of the behavior, occurrence, etc. of invertebrates by two foremost authorities. Readable and packed with information.

TEACHER INFORMATION
FOR
SEA WEEK CURRICULUM MATERIALS

-

1st GRADE

Name of Sea Week Materials	Contents and/or Use
ACTIVITY BOOK	
Worksheet # 1 - Sponges.	Coloring
Worksheet # 2 - Guess What I Am	Dot-to-Dot, Reading
Worksheet # 3 - Sea Urchin	Fill in words.
Worksheet # 4 - Sea Anemones	Labeling
Worksheet # 5 - Anemone	Poem, Illustrating
Worksheet # 6 - Jelly Fish	Reading, Fill in words.
Worksheet # 7 - Jelly Fish	Dot-to-Dot
Worksheet # 8 - Sea Cucumber	Cross Word Puzzle
Worksheet # 9 - Barnacles	Counting
Worksheet #10 - Barnacles	Reading, Sentence Completion
Worksheet #11 - Hermit Crab	Reading, Structural Analysis
Worksheet #12 - Hermit Crab	Writing
Worksheet #12A Crab	Reading, Comprehension
Worksheet #13 - Crab	Counting
Worksheet #14 - Worms	Reading
Worksheet #15 - Worms	Alphabet, Dot-to-Dot
Worksheet #16 - Get Some Shrimp to Eat	Maze
Worksheet #17 - Sandhopper	Reading
Worksheet #18 - Amphipods/Sandhopper	Counting
Worksheet #19 - Shrimp	Reading

Name of Sea Week Materials	Contents and/or Use
Worksheet #20 - Mollusks	Counting
Worksheet #21 - Snails	Visual Discrimination
Worksheet #22 - Clams, Cockles, Mussels	Reading, Matching
Worksheet #23 - Bivalves	Reading, Comprehension
Worksheet #24 - Clams, Mussels, Cockles	Writing
Worksheet #25 - Starfish	Word Knowledge
Worksheet #26 - Starfish	Dot-to-Dot
Worksheet #27 - Fish	Word Knowledge
Worksheet #28 - Color-By-Number	Color Recognition, Numbers, Structural Analysis
Worksheet #29 - Make a Fish	Motor Coordination, Visual Perception Counting (game)
Worksheet #30 - Cephalopods	Color by Number
Worksheet #31 - Sea Animals	Matching
Worksheet #32 - Make a line to the Marine Animals.	Visual Discrimination

COLOR ILLUSTRATIONS

Posters = 20x30 = Full color

2 - What Are Marine Animals? *

2 - What Are Marine Plants? *

Cards for above Posters - (color drawings)

2 sets - Marine Plant and Animal Cards *

Posters = 20x30 = Full color

2 - What is a Plant? *

2 - What is an Animal? *

Cards for above Posters - (color drawings)

2 sets - Plant and Animal Cards *

Slide/Tape Show * Marine Life of Alaska's Shores

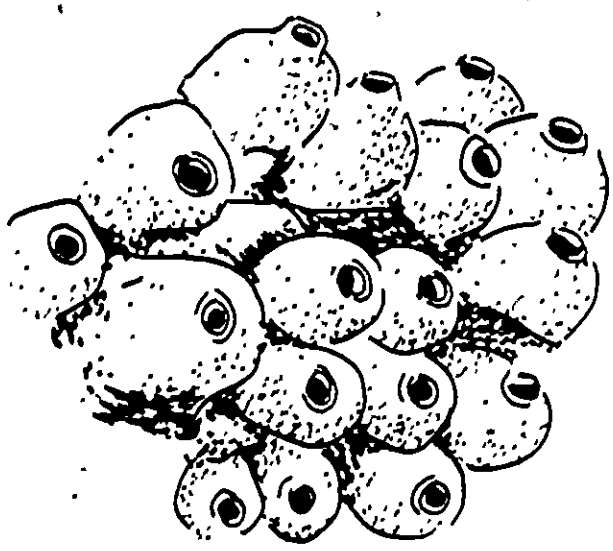
* Available from the South East Regional Resource Center, 538 Willoughby Avenue, Juneau, Alaska 99801

Activity Book

For First Grade

Sea Week

Sponges



Color this purple.

Color this red.

Guess what I am.

I am an animal.

I live in the ocean.

I cannot move.

I have no head or tail or legs.

I can be yellow or red or orange or purple.

When I am alive I am soft.

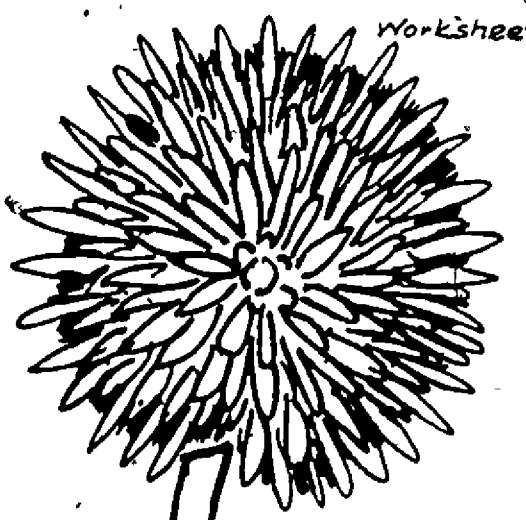
I feel gritty.

Follow the numbers and find out what I am.

I am a _____

_____.

Sea Urchin



Circle the correct word and write it on the line.

Sea Urchins are _____

plants animals

Sea Urchins have _____

spots spines

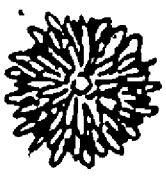
They have _____ feet.

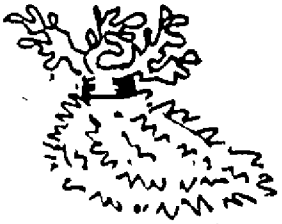
tube tall

They live _____ the mud.

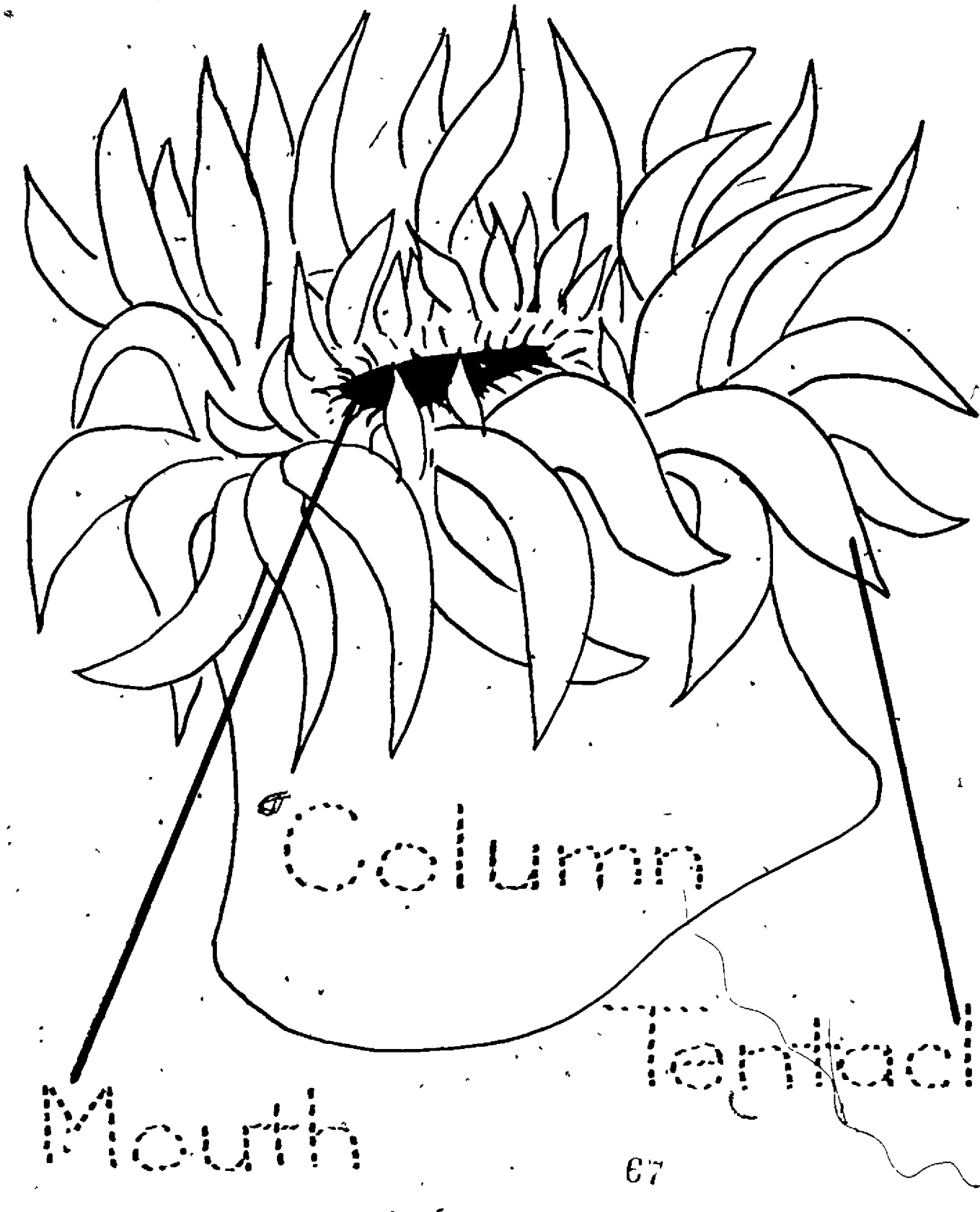
on in

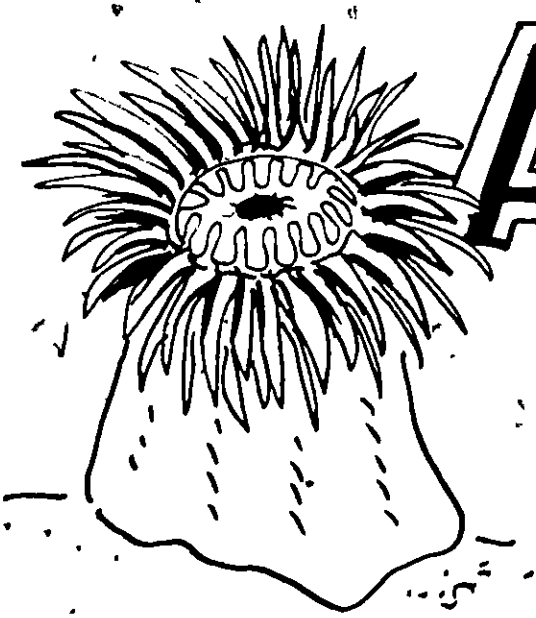
Circle the pictures that go together.





Sea Anemones





ANEMONE

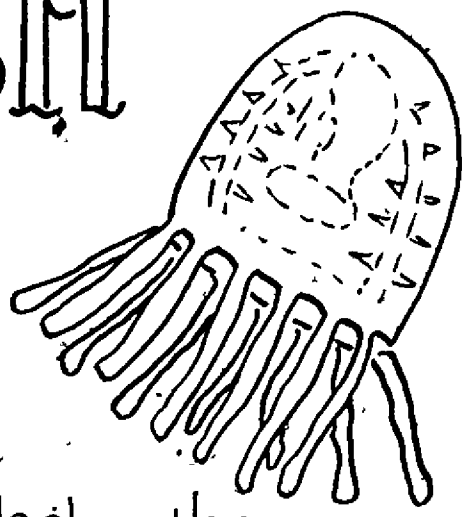
Tall or short,
Like a flower
With many petals,
The anemone
Lives in the sea.

The anemone catches
And often eats
Big sea animals
Like jellyfish and crab.

Red, green, pink,
Orange or white,
Sea anemones are
A very pretty sight.

Draw a sea anemone and color it.

Jellyfish



A jellyfish is like an anemone that floats in the sea.

Both are soft.
Both have tentacles that help them get food.
Both have a mouth in the middle of the tentacles.

The tentacles of a jellyfish can sting. They can hurt people.

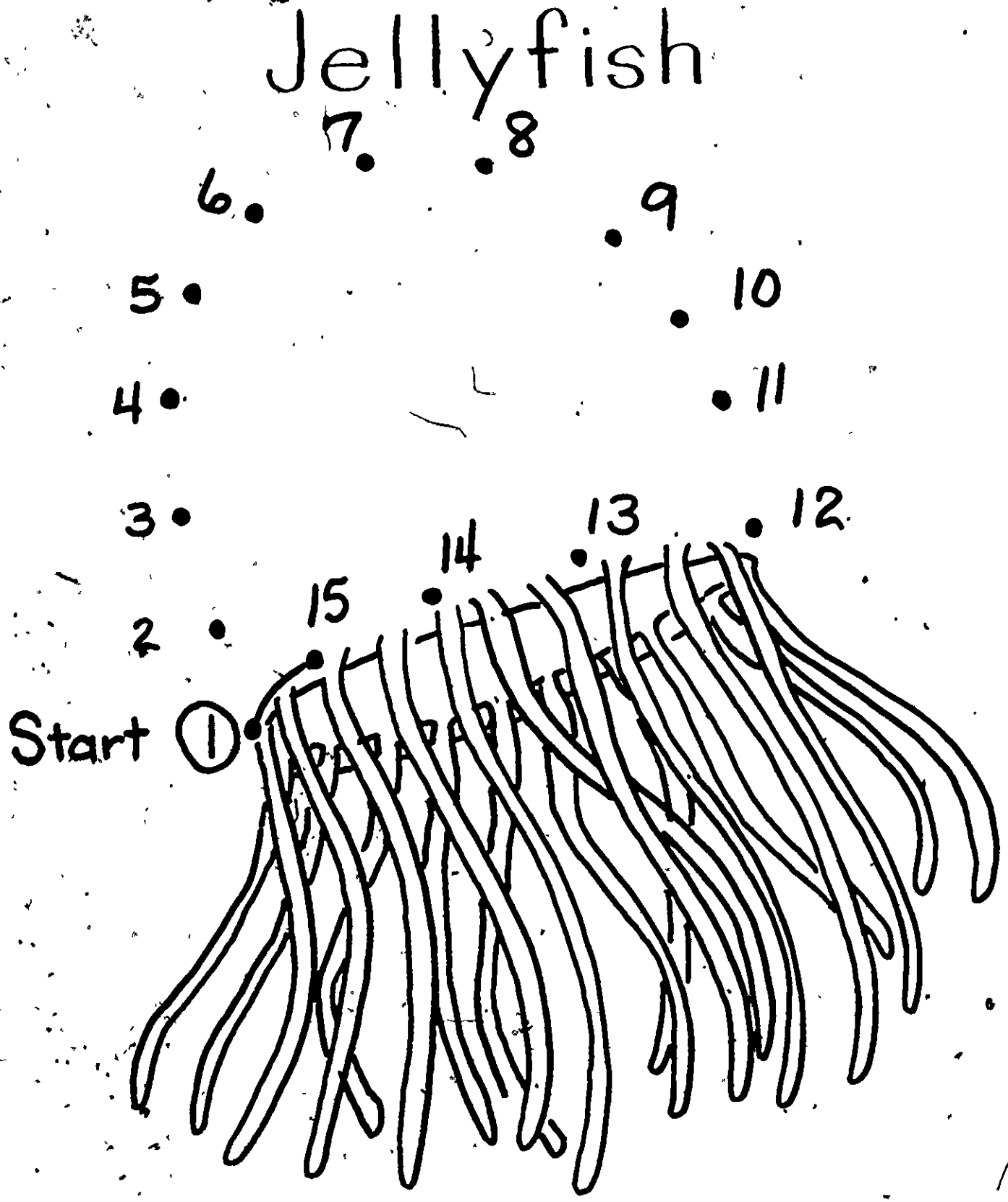
Circle the words that make the sentences true.

1. A jellyfish _____ in the sea.
   boats floats coats

2. Tentacles help jellyfish get _____.
   room noon food

3. Jellyfish have a _____ in the middle of their tentacles.
   mouth moon much

Jellyfish

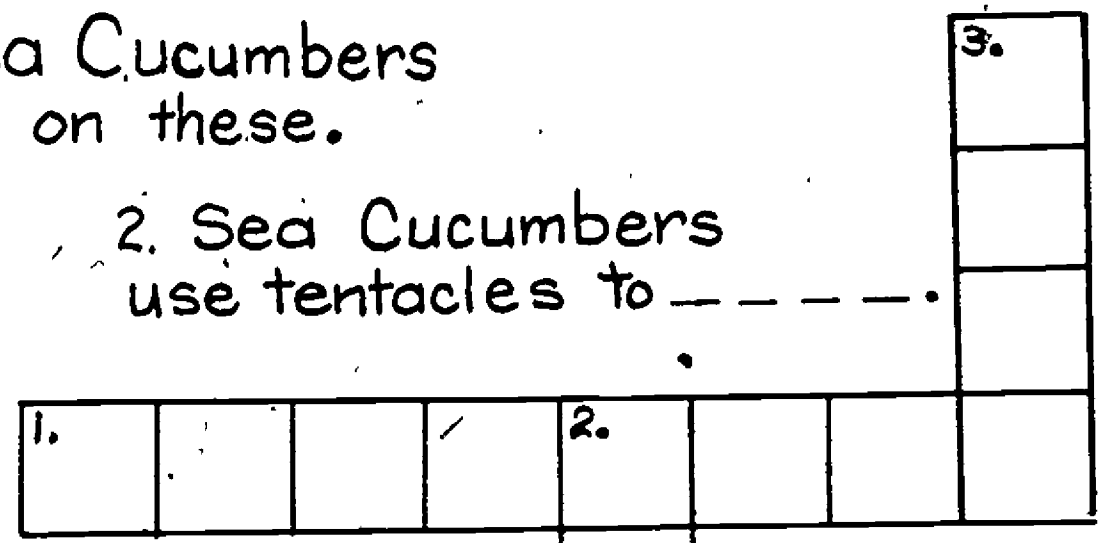


SEA CUCUMBER

1. Sea Cucumbers walk on these.

2. Sea Cucumbers use tentacles to _ _ _ _.

3. Sea Cucumbers are _ _ _ _.

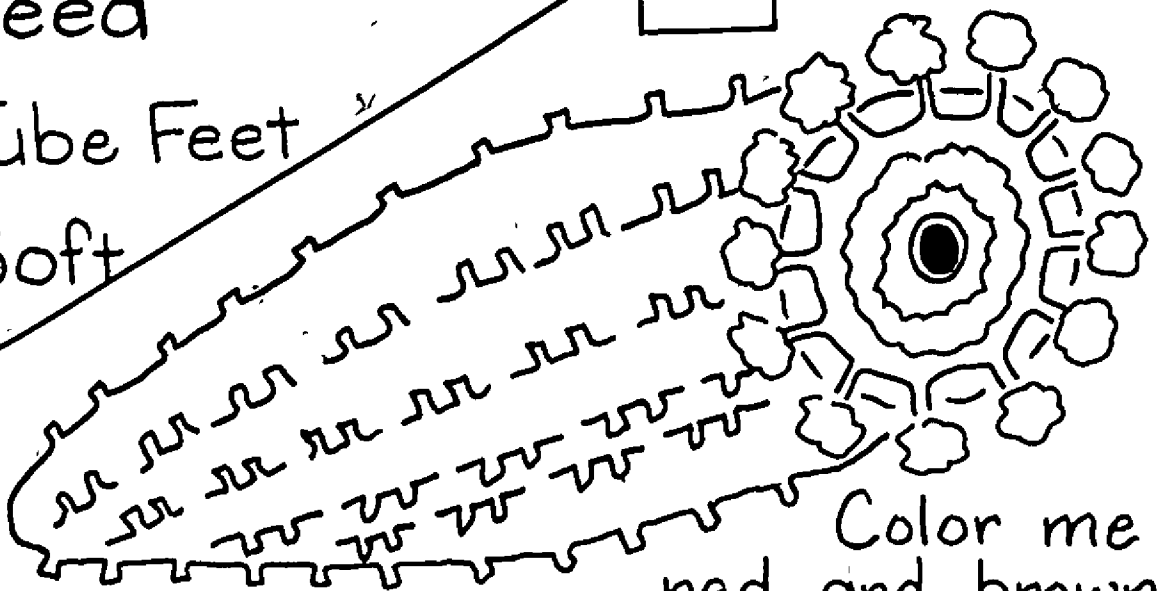


Use these words.

Feed

Tube Feet

Soft

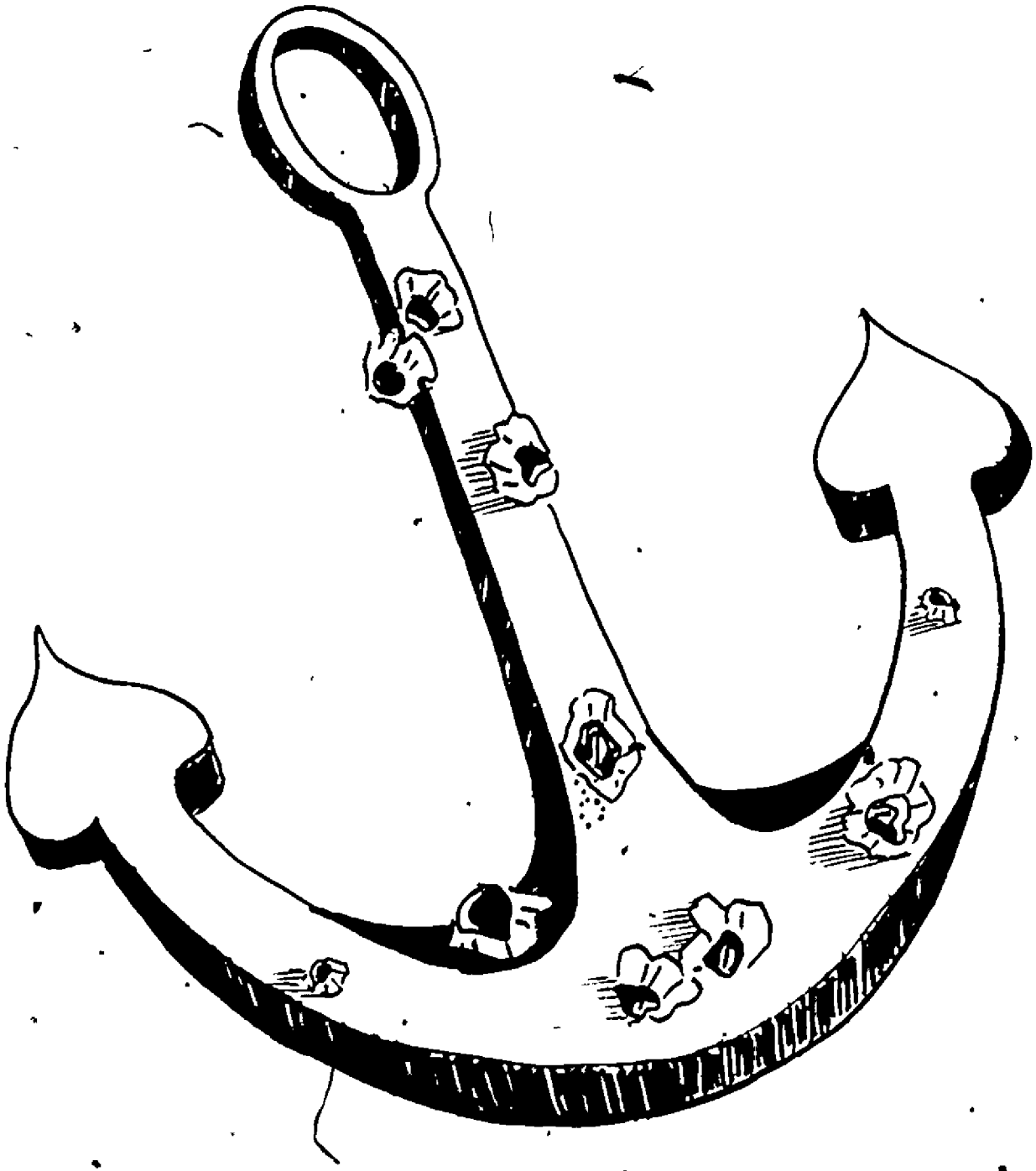


Color me red and brown.

First Grade

worksheet #9

Barnacles



How many barnacles.

Circle the correct answer.

3 10 4 72 8 5 9 2

Barnacles

are Crustaceans.

A barnacle has a shell.

A young barnacle glues its head to a rock.

It builds another harder shell around itself.

The hard shell has a door at the top.

The barnacle eats by waving its legs out the door.

Draw lines to words that tell about barnacles.

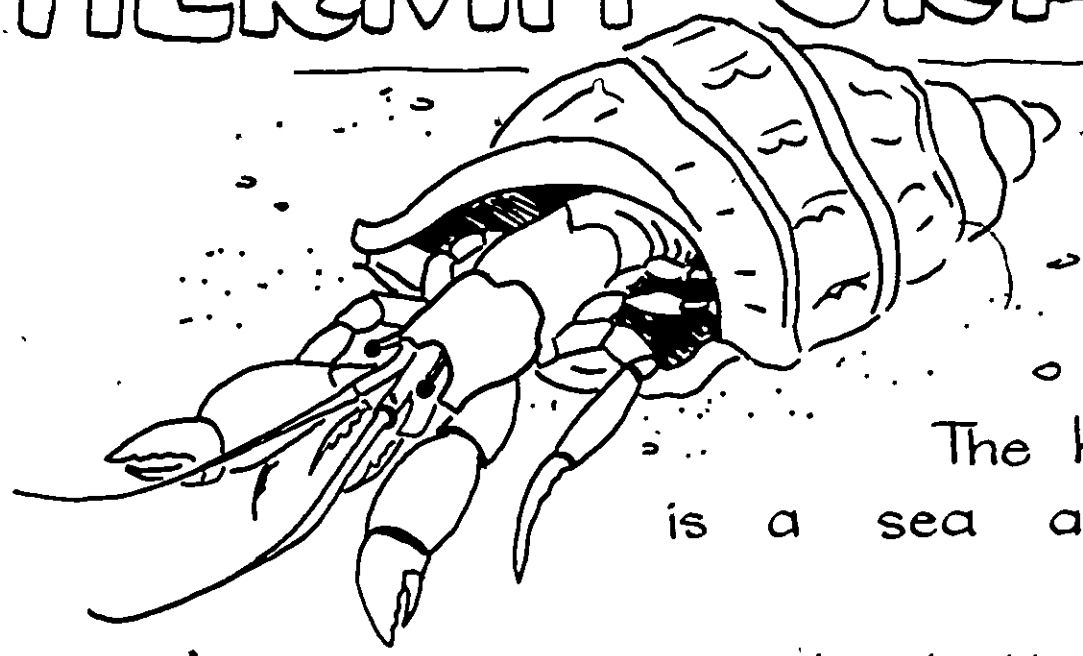
Barnacles

have shells
have heads
have tails
have doors
have legs

First Grade

Worksheet #11

HERMIT CRAB



The hermit crab is a sea animal.

It lives in a snail shell.

The snail shell is its house.

When the hermit crab grows bigger, it must find a bigger snail shell.

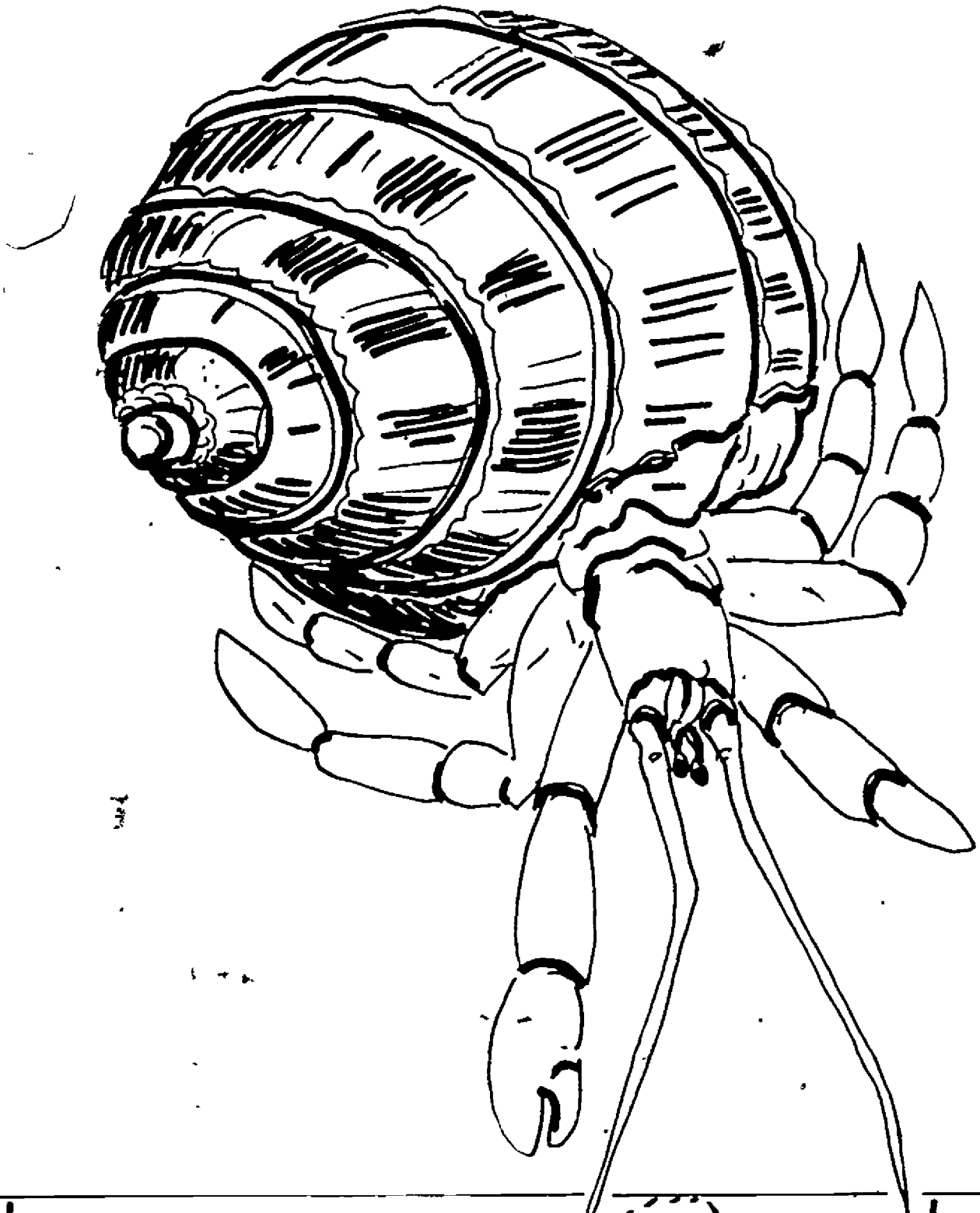
The hermit crab wears its house!

Write the word that makes the sentence true.

1. A hermit crab is a _____ animal.
   (see / sea)

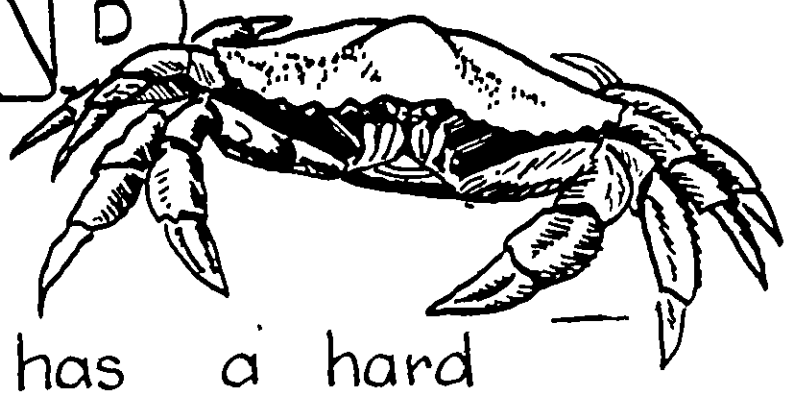
2. It lives in a _____ shell.
   (snail / same)

Hermit Crab



Hermit Crab

CRAB



A crab has a hard outside shell.

Its shell protects its soft body.

A crab has legs with joints.

It has strong claws.

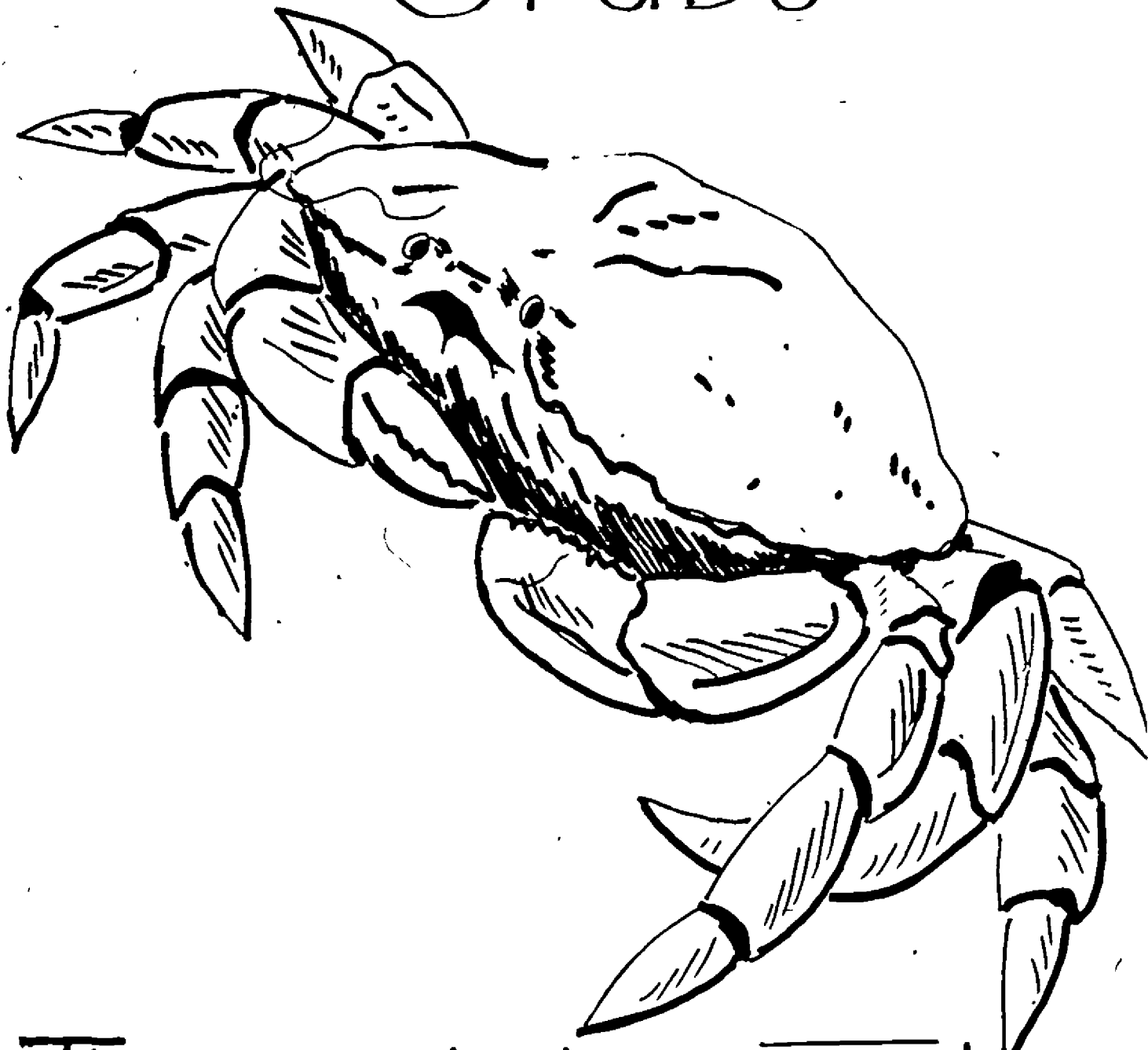
Some crabs can run fast.

Some crabs are good to eat.

Circle the words that are true about crabs.

hard shell	soft body
legs with joints	good to eat
inside shell	hard body
outside shell	can run fast
legs without joints	
strong claws	

Crabs



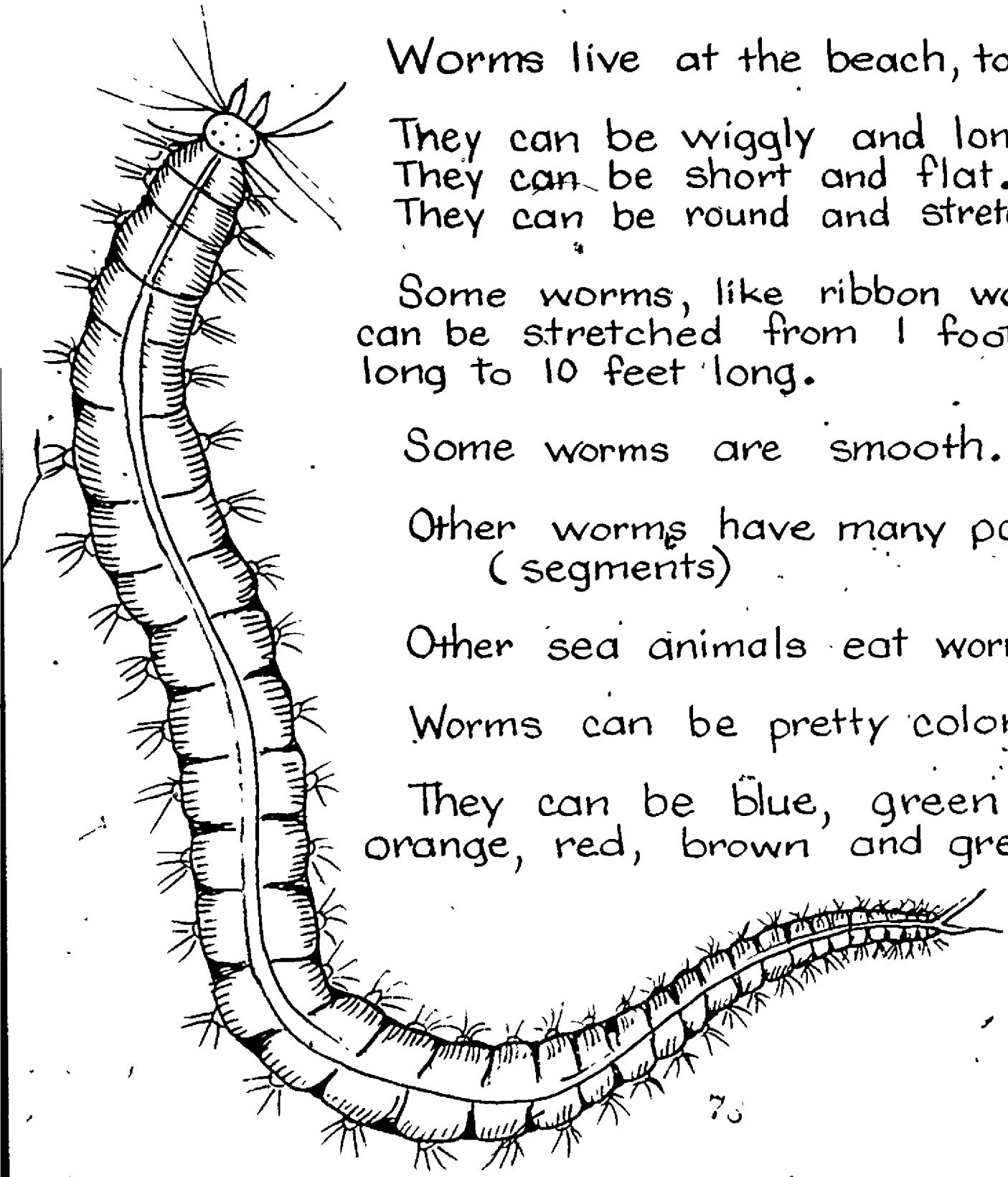
This crab has ____ legs.

____ of them are claws.

First Grade

Worksheet #14

WORMS



Worms live at the beach, too.

They can be wiggly and long.
They can be short and flat.
They can be round and stretchy

Some worms, like ribbon worm
can be stretched from 1 foot
long to 10 feet long.

Some worms are smooth.

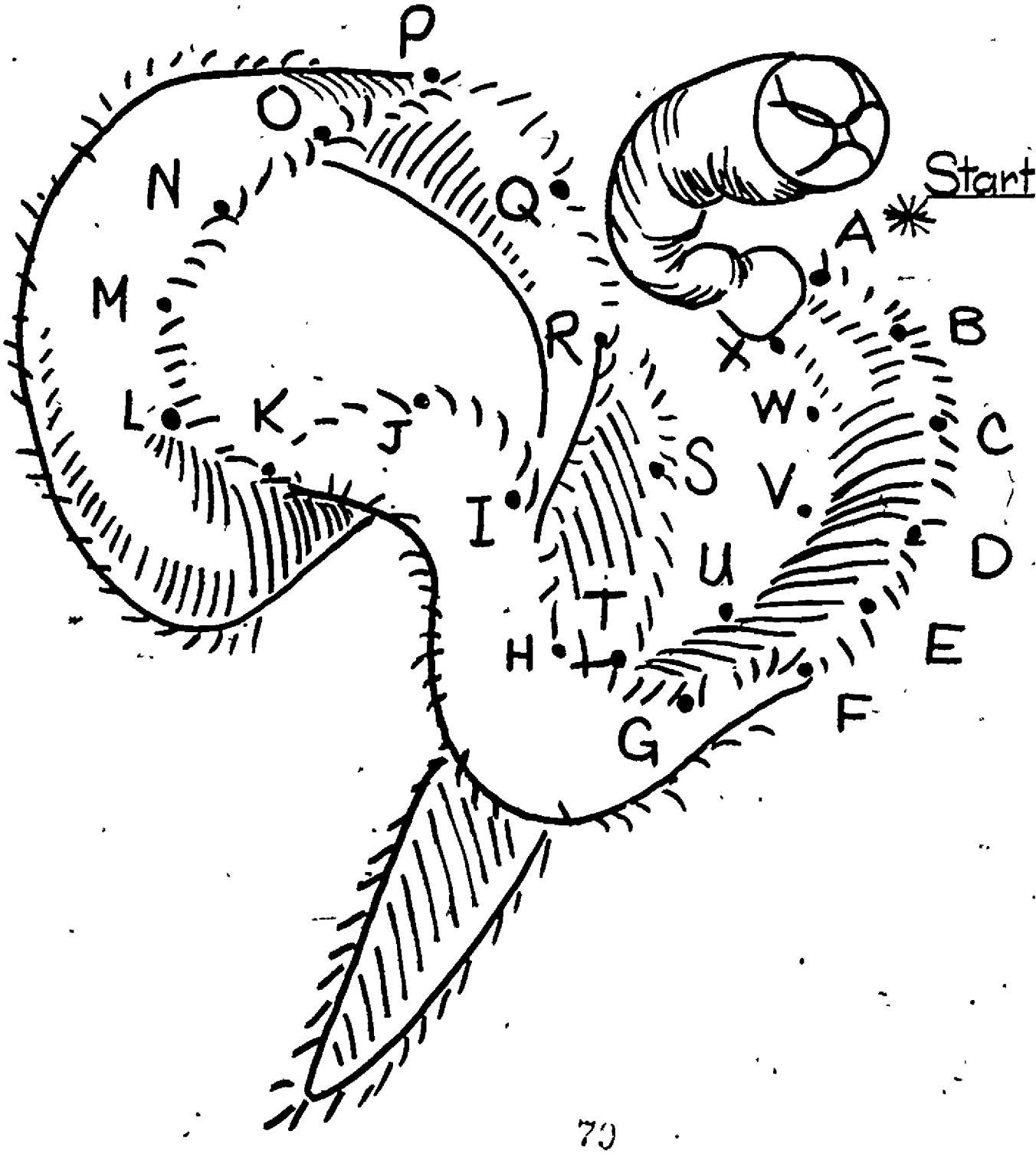
Other worms have many parts
(segments)

Other sea animals eat worms.

Worms can be pretty colors.

They can be blue, green,
orange, red, brown and grey.

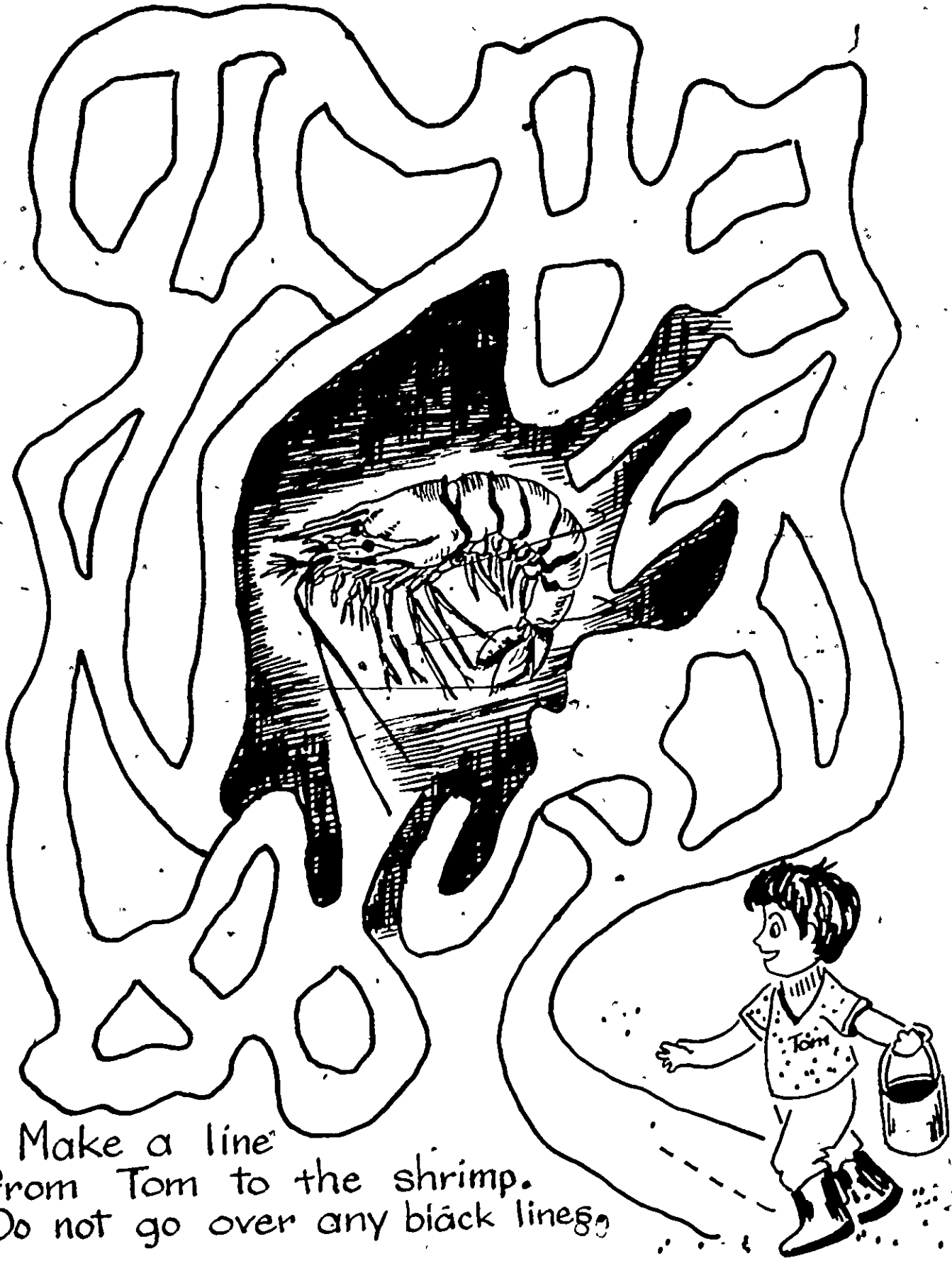
Worms



First Grade

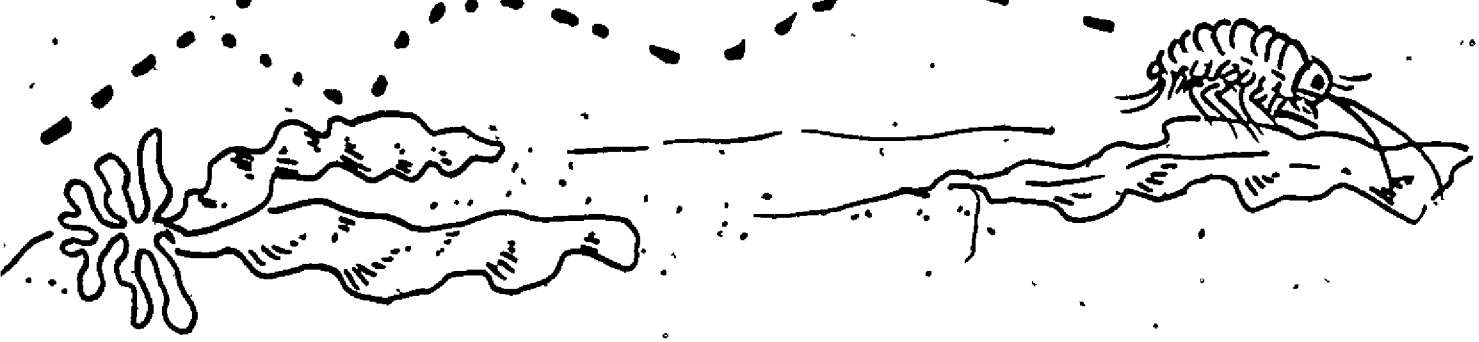
Worksheet #16

Get some shrimp to eat.



Make a line from Tom to the shrimp. Do not go over any black lines.

SANDHOPPER



Sandhoppers are all over
at the beach.

They are fun to catch.

They wiggle.

Sandhoppers have
walking legs,
swimming legs,
and jumping legs.

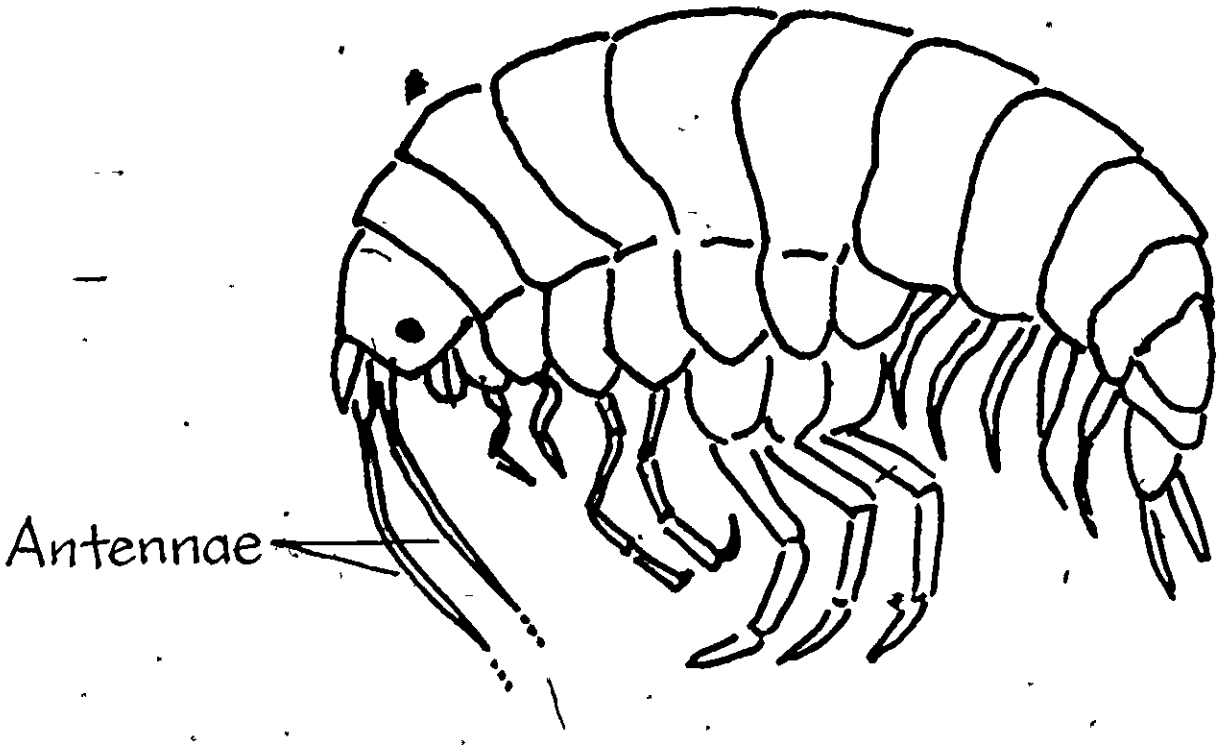
They are very small.

Sandhoppers hop on seaweeds
at the beach.

They eat dead sea animals.

Amphipods

Sandhopper



Count the small legs.
How many small legs? _____

Count the long legs.
How many long legs? _____

Shrimp

Shrimps and sandhoppers have a hard shell on the outside of the body.

As they grow, they wiggle out of the old shell.

The soft skin under the old shell turns into a new and bigger shell.

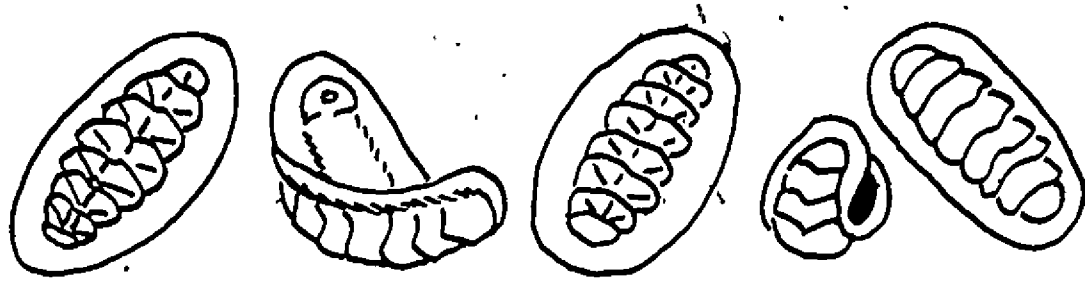
Shrimps have walking legs, swimming legs, and jumping legs.

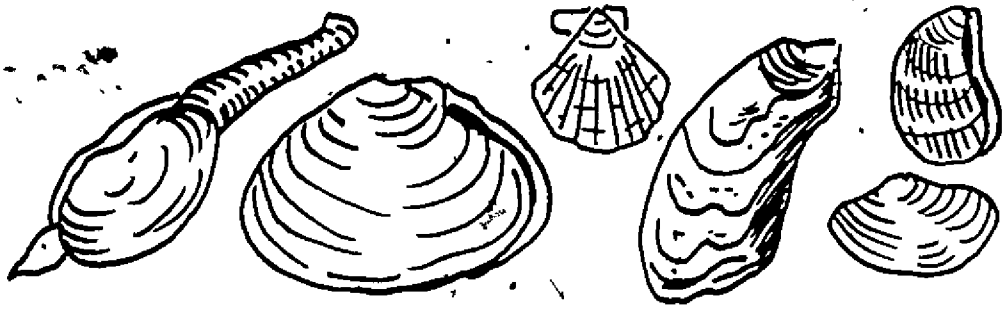
Shrimps can be ½ inch to 6 inches long.

You might see a shrimp in a a tidepool.

Mollusks

How Many Chitons? _____



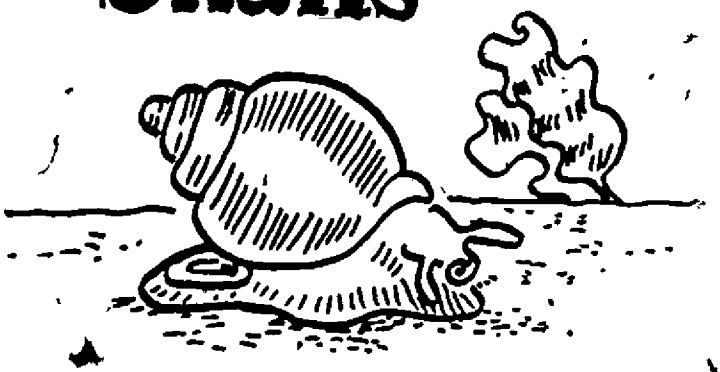


How Many Bivalves? _____

How Many Limpets? _____

How Many Snails? _____

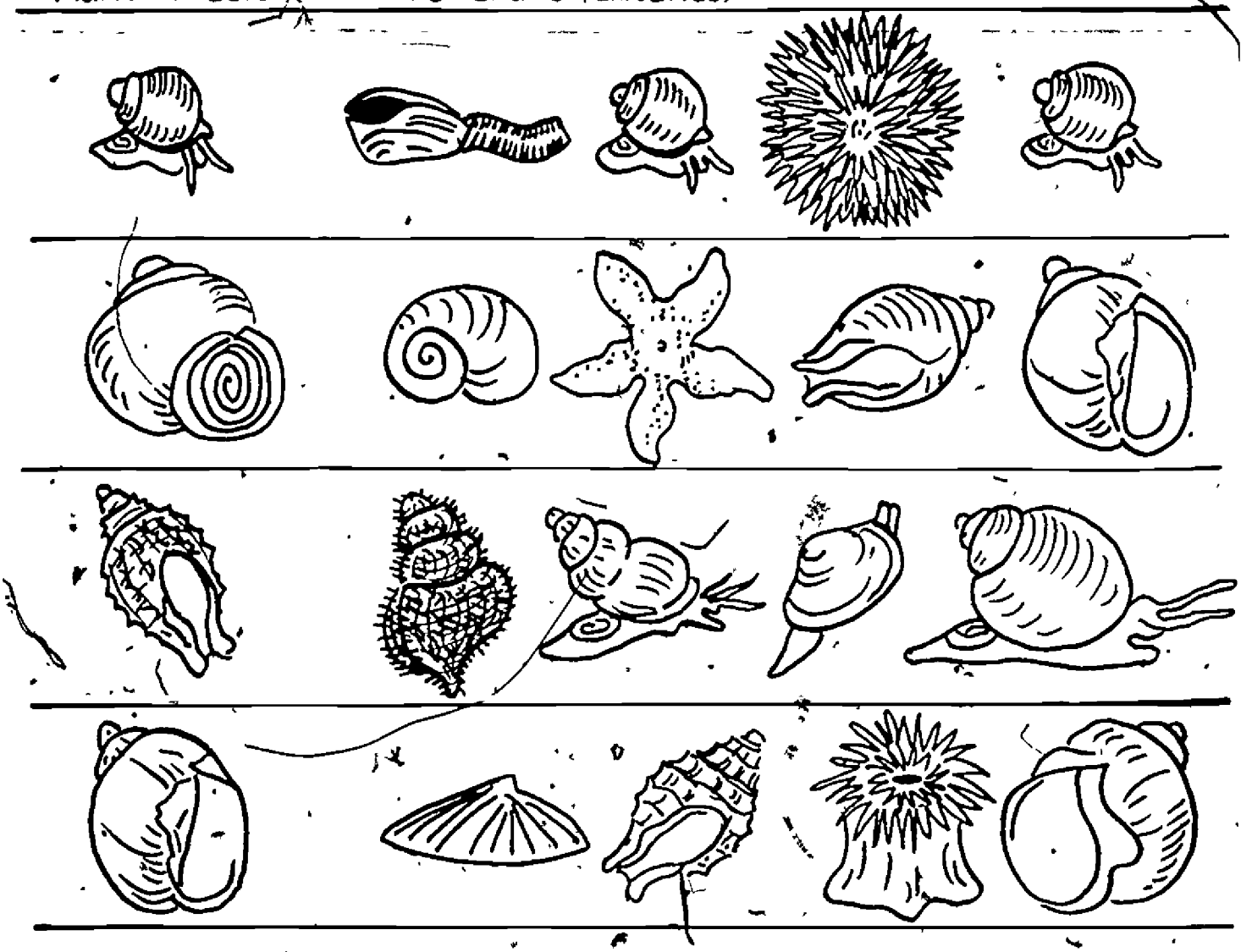
Snails



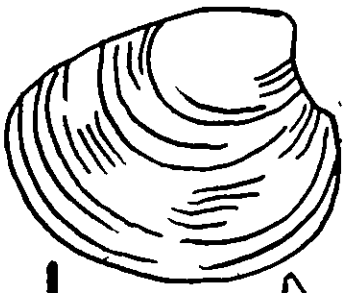
Snails are univalves.

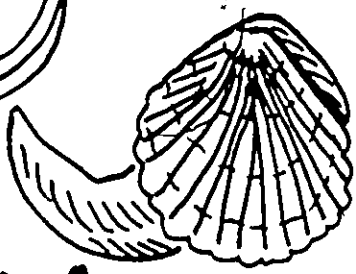
Univalves have one part to their shells.

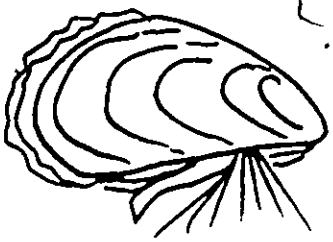
Mark or color all the snails (univalves)



Clams Cockles and Mussels



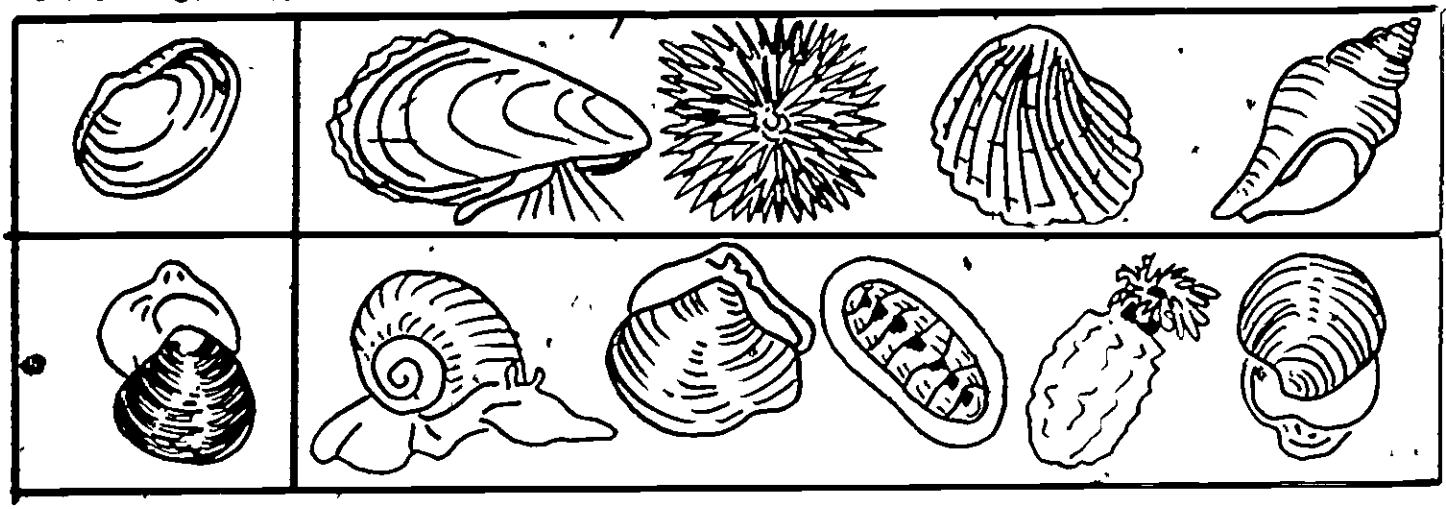




Clams, cockles and mussels are bivalves. Bivalves have two parts to their shells.

Matching

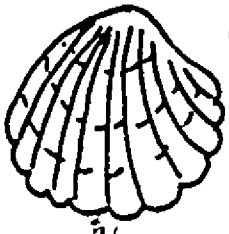
Color or mark all the bivalves.



Bivalves

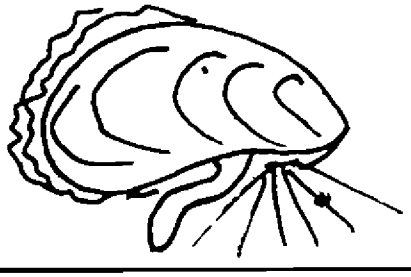
Draw lines to the right words.

1. Clams and cockles



2. We eat

3. Mussels



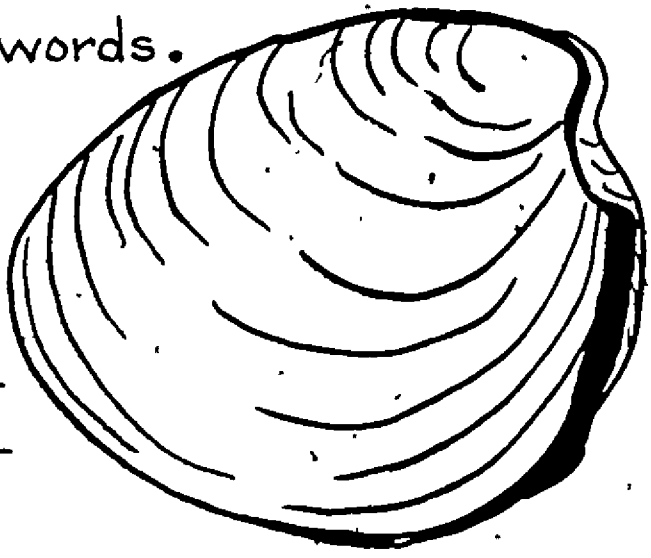
live on rocks.	clams.
live in the sand.	

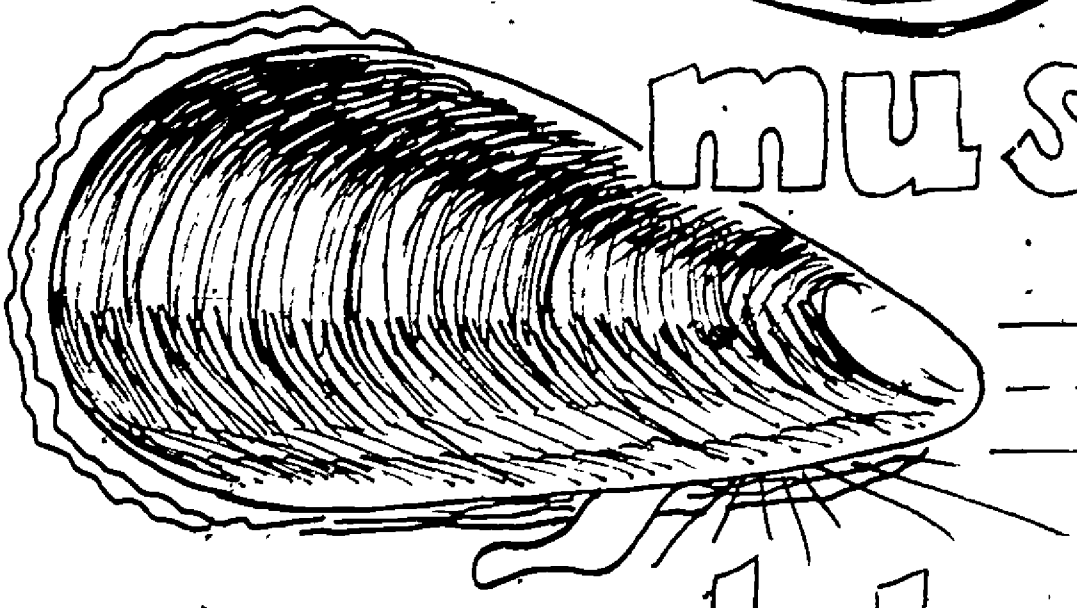
First Grade

Worksheet #24

Write the words.

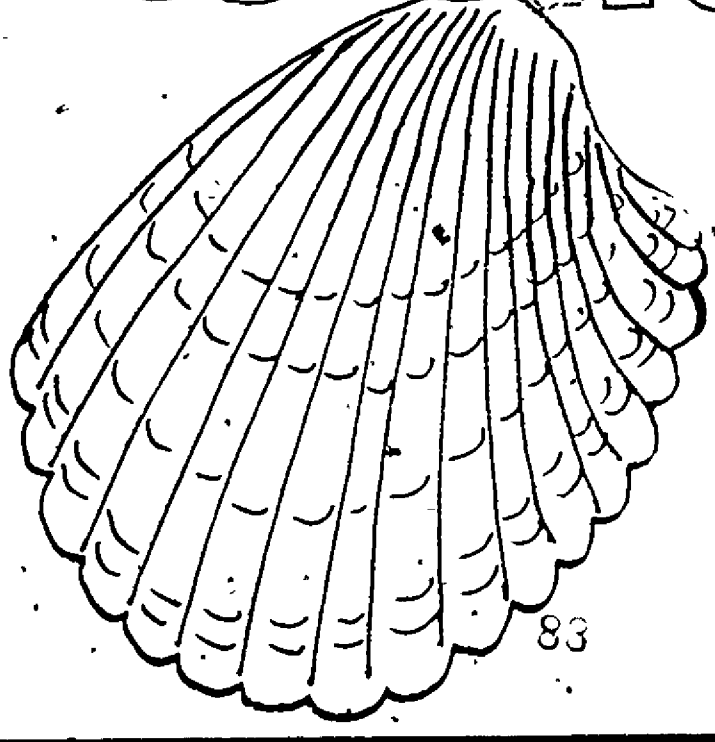
clam





mussel

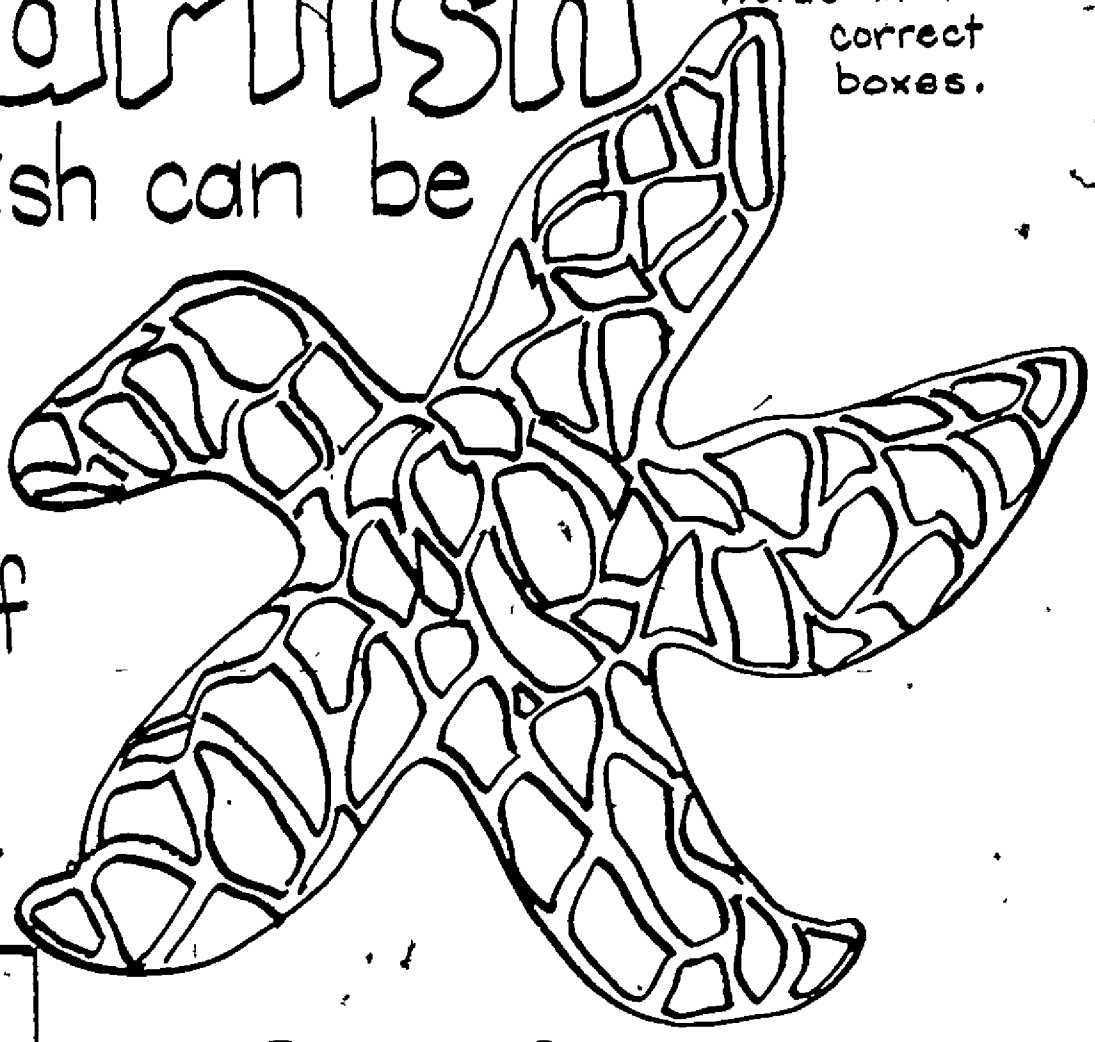
cockle



Starfish

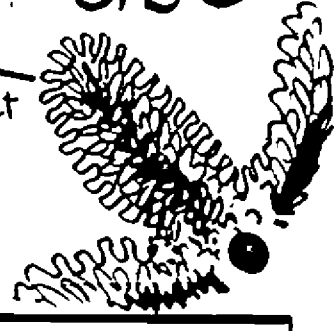
Cut and paste words in the correct boxes.

Starfish can be [ ].



Some of them eat [ ].

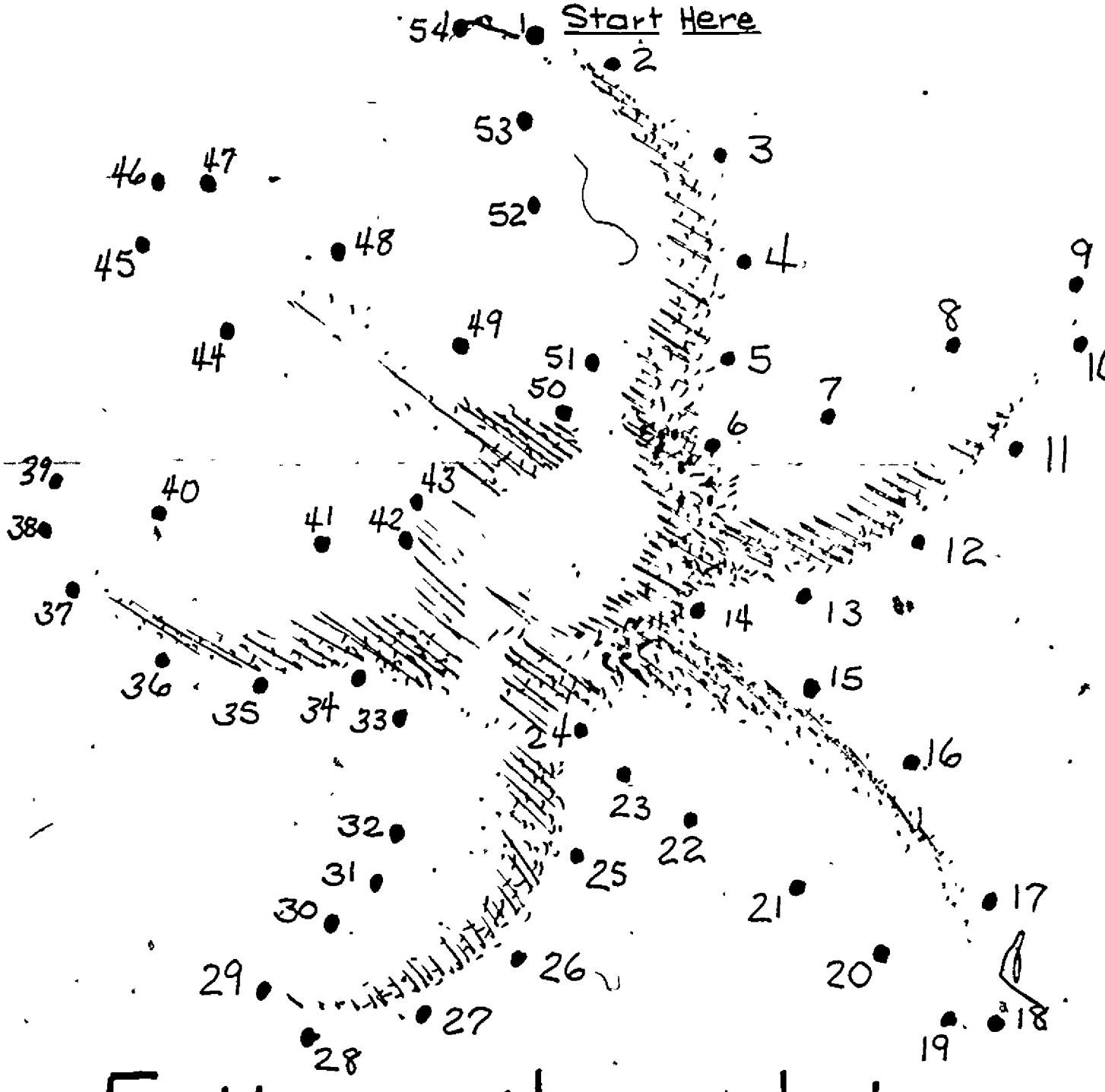
Starfish use [ ] to move.



They live at the [ ].

tube feet	beach	big	clams

Star Fish



Follow the dots.

FISH

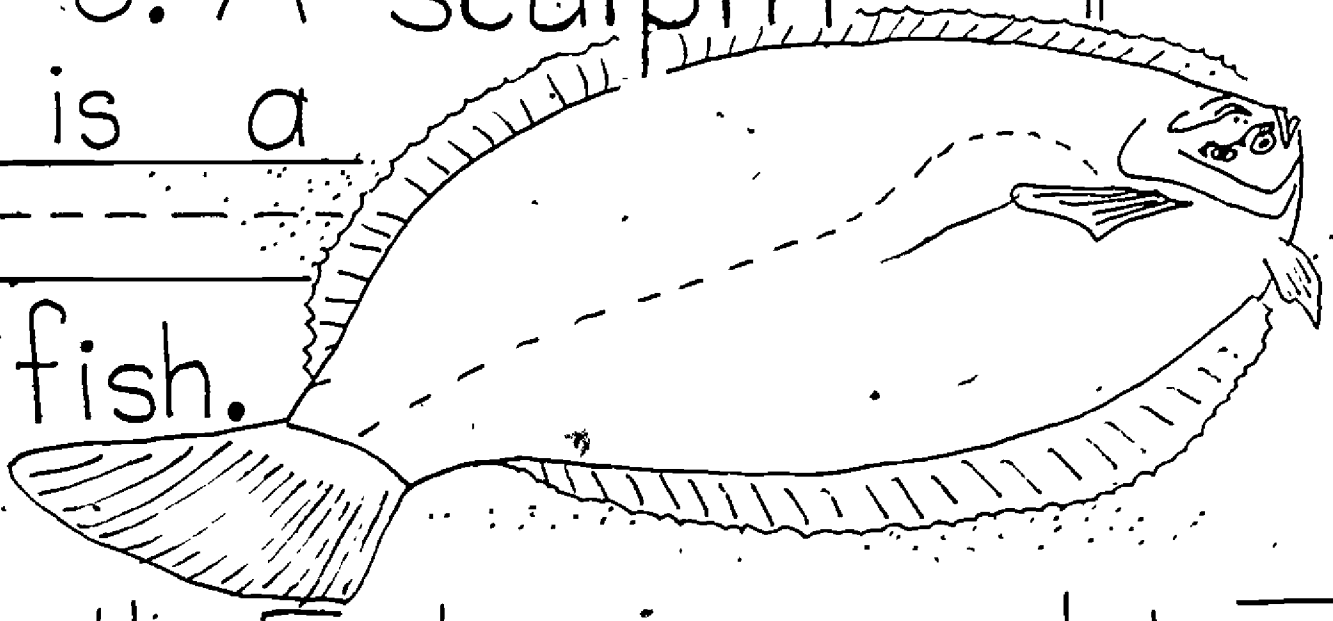
Fill in the blanks with one of these words.

eat
big
gills
small
fins

1. Fish breathe with _____.

2. A halibut is a _____ fish.

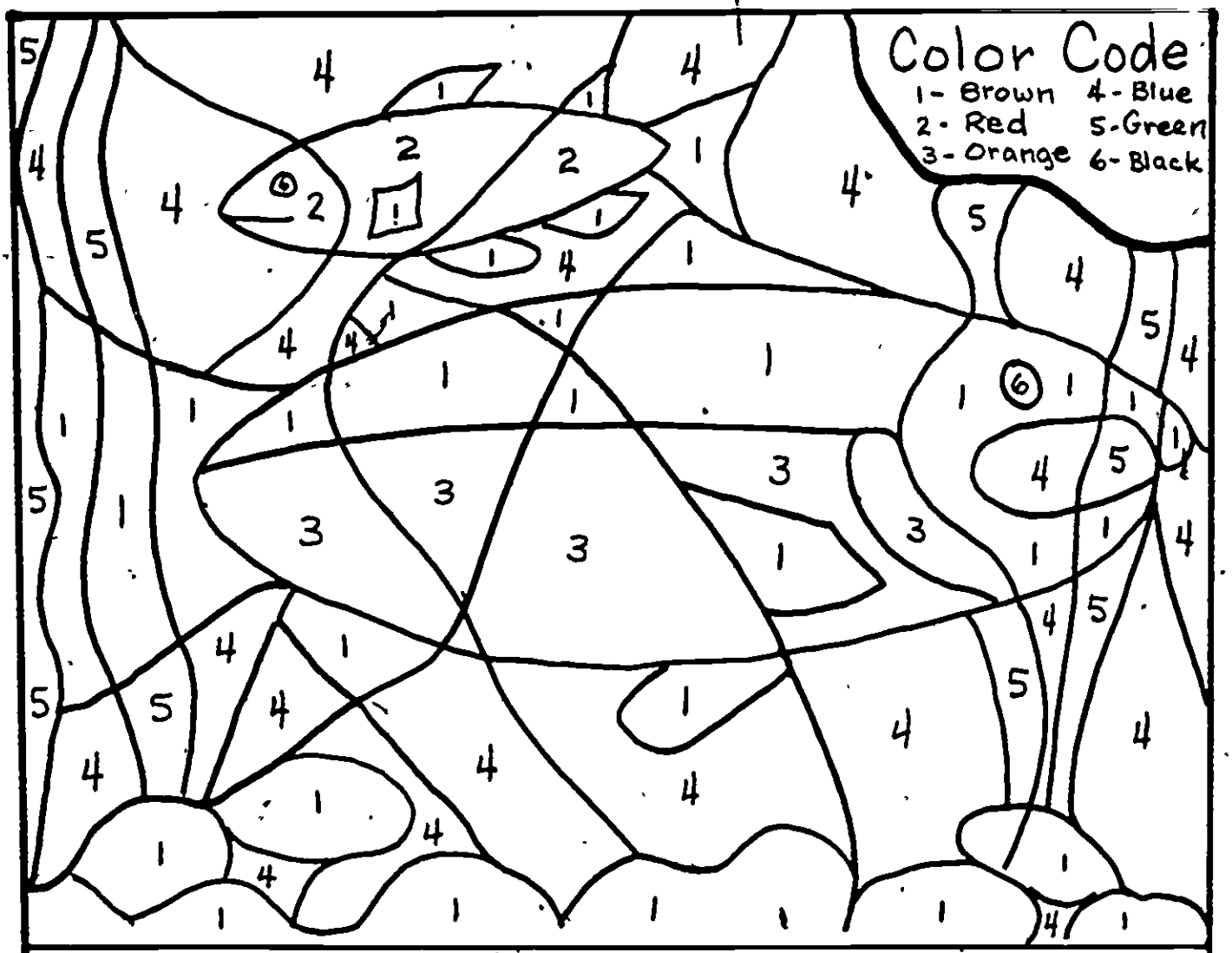
3. A sculpin is a _____ fish.



4. Fish are good to _____.

First Grade

Worksheet #28



Write letters in the boxes:

I made a □□□□.

h i f s

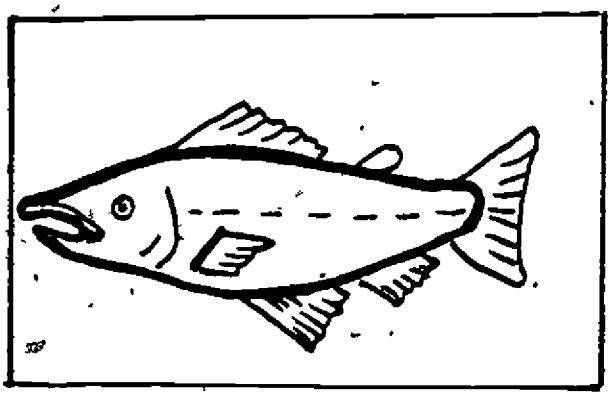
Fish breathe with _____

gills _____ bills

Fish use _____ to swim.

pins fins

Make a fish.



Start

fins

tail

fins

MAKE A FISH - DIRECTIONS:

Activity I:

1. Discuss the parts of a fish (chinook salmon)
   fins
   tail fin
   mouth
   eye

2. Color and cut out parts of a fish.

3. Assemble on a large piece of colored construction paper.

4. Draw background underwater scene. Include:
   rocks
   seaweeds
   small fish
   other marine animals
      squid
      octopus
      star fish
   or: glue dried seaweed, shells, and small drift to the picture

Activity II:

1. Same as above.

2. Trace around parts of a fish on colored construction paper
   e.g. make fish body one color
        make fins another color

3. Paste parts together.

4. Hang with string to make a dry salt-water aquarium or fish mobile.

Activity III:

1. Give each player a copy of the fish

2. Put a coin or checker on the circle with start in it.

3. Have players shoot the coin or checker by snapping it with their fingers, causing the penny to land on a part of the fish.

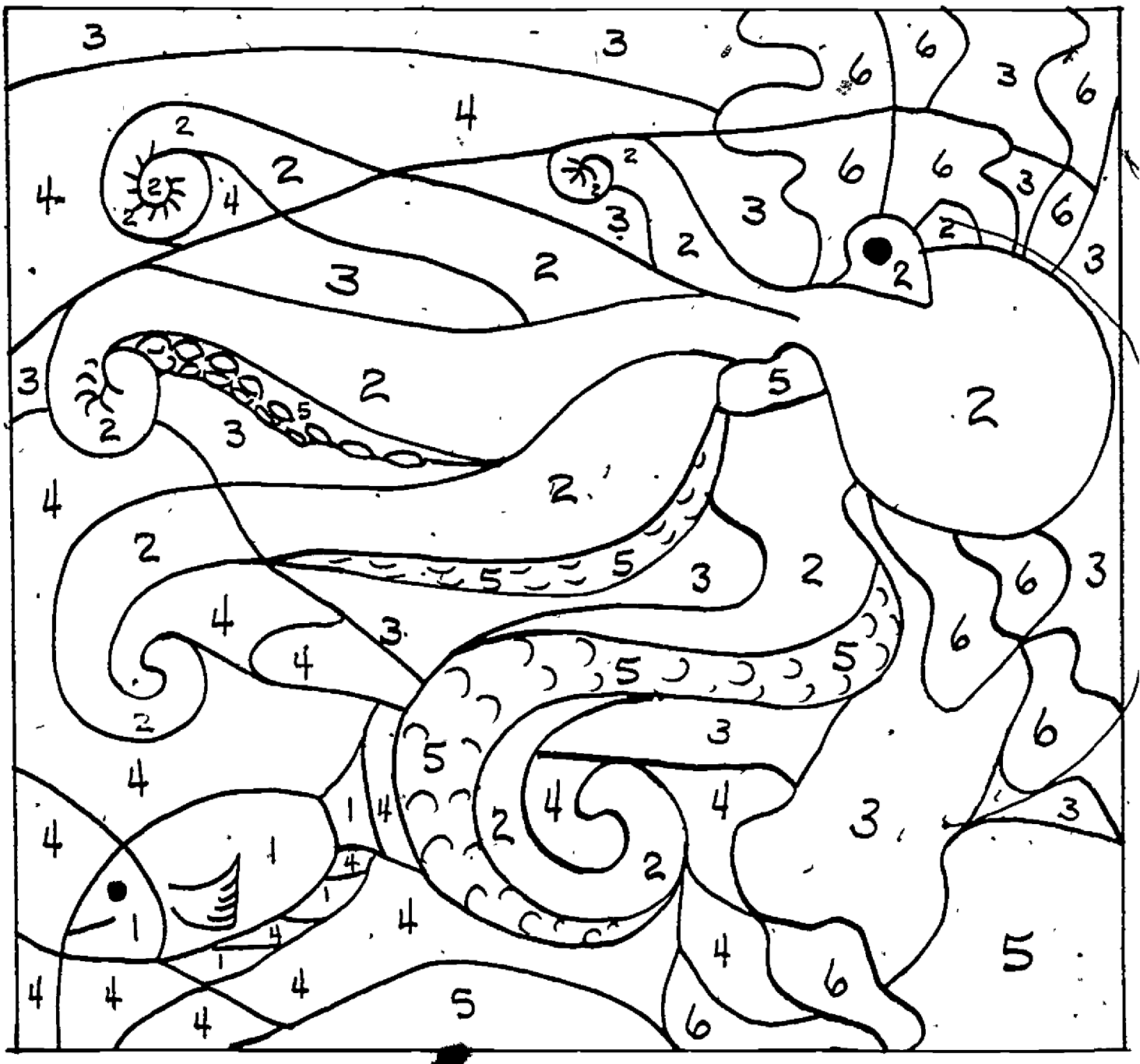
4. On another piece of paper, the player draws the part on which the coin or checker landed.

5. The first player to draw a complete fish, is the winner.

First Grade

Worksheet #30

Cephalopods



Find the octopus

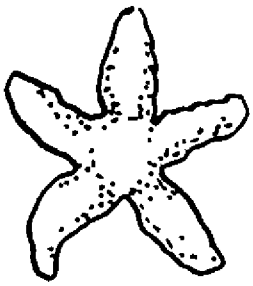
1 - red
2 - orange
3 - Black
4 - blue
5 - brown
6 - green

First Grade

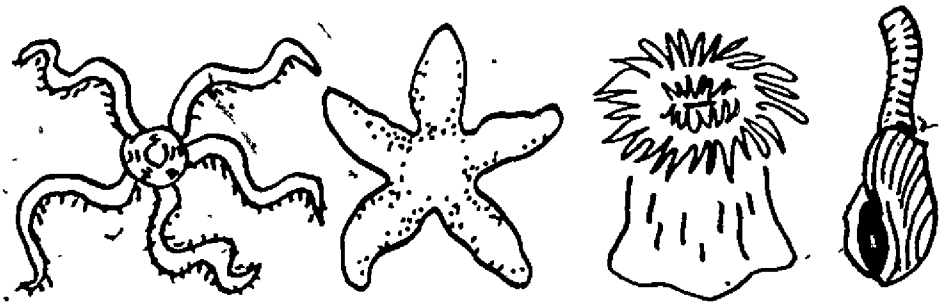
Worksheet #31

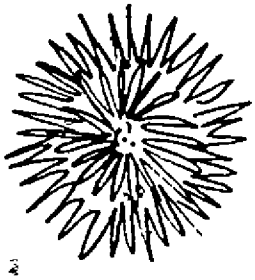
Matching

Circle and color the matching sea animals.

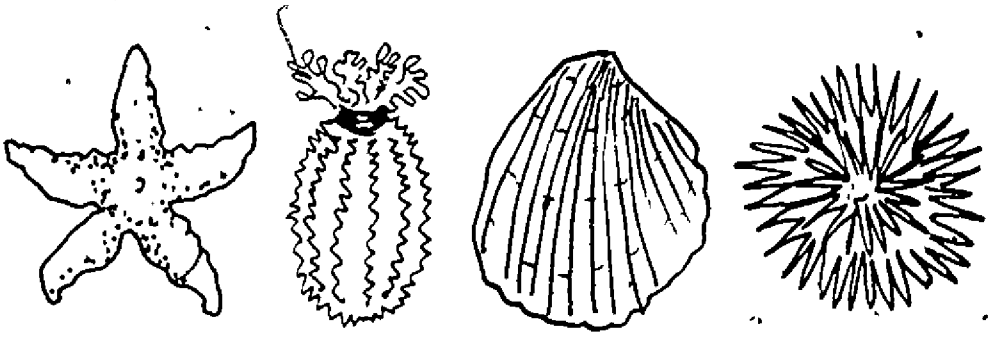


Starfish

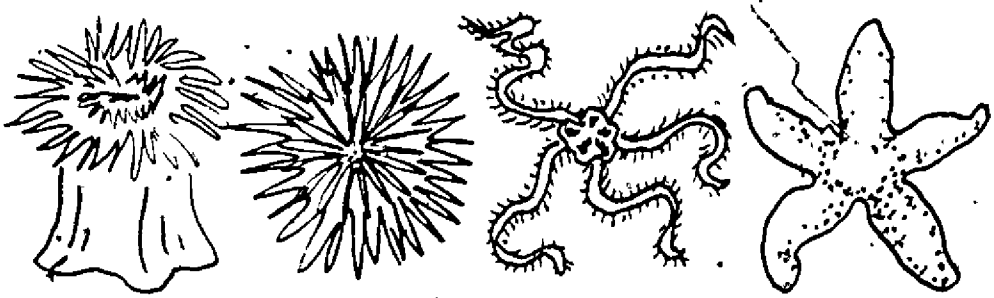




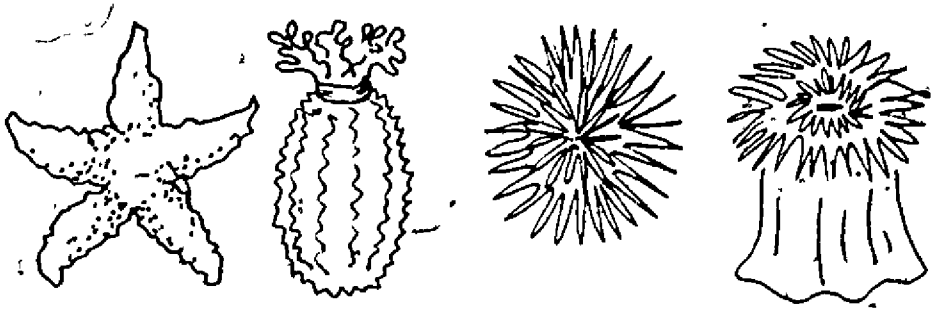
Sea Urchin



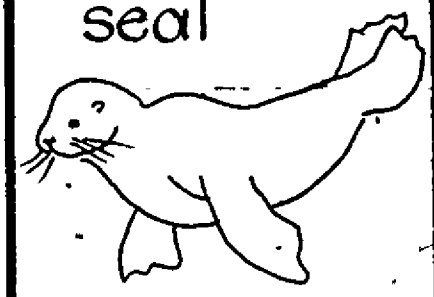
Brittle Star



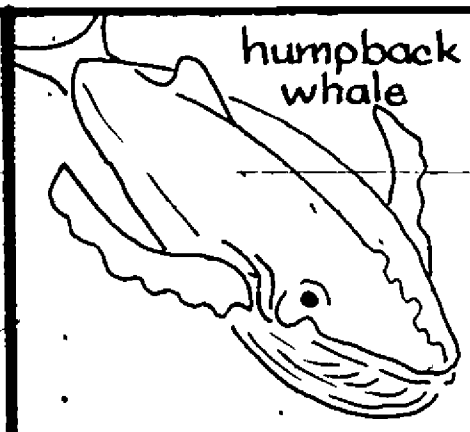
Sea Cucumber

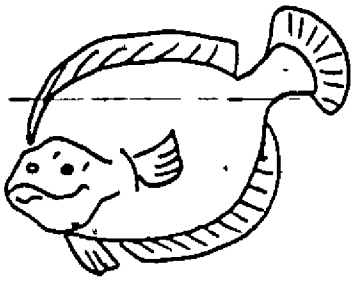


seal



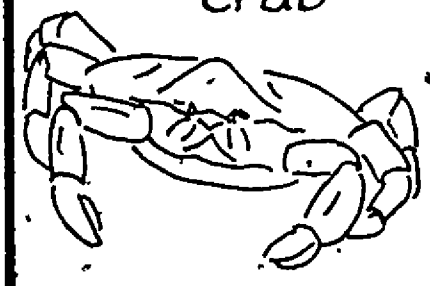
humpback whale



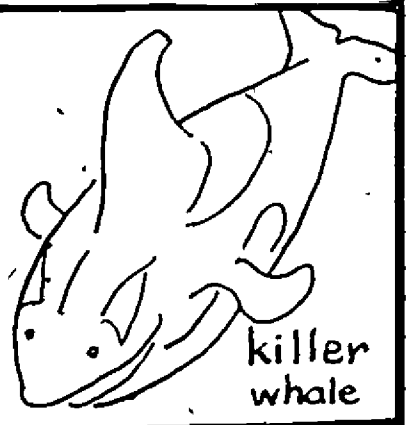


fish

crab



Make a line to the Marine Mammals

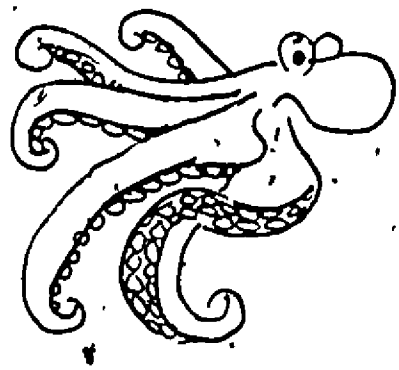


killer whale

sea lion

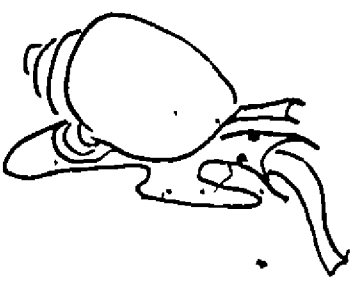
sea horse

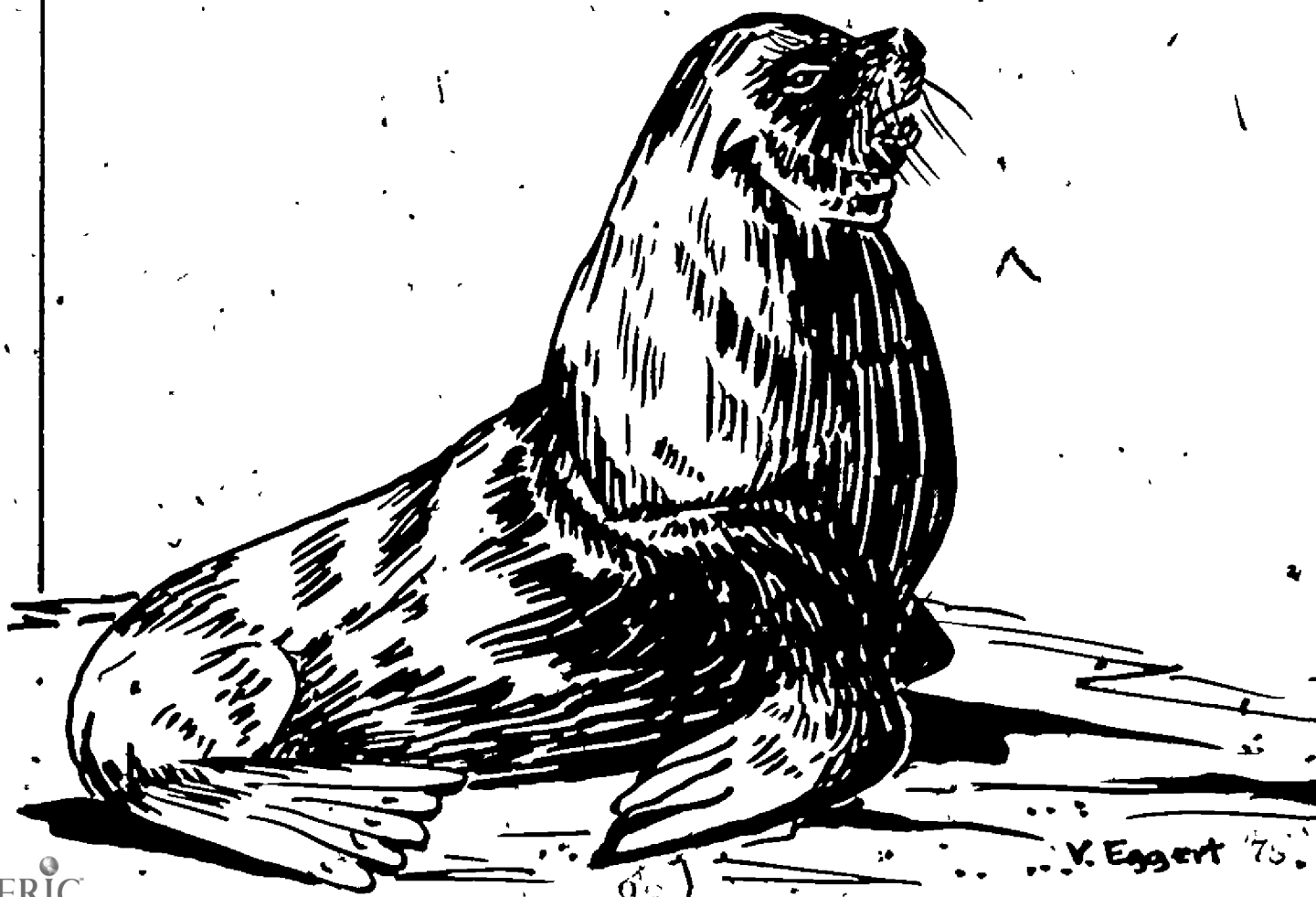
octopus



porpoise

snail




V. Eggert '75

STEPS TO ORGANIZING A SEA WEEK IN YOUR COMMUNITY

I. Familiarize yourself with the Sea Week curriculum and introduce it to other interested teachers and parents.

II. Catalog the resources in your area. Where are the good beaches? When are the good low tides? Are there any agency, hatchery, or museum personnel that would be available as speakers and/or for field trips?

III. Draw up a well-thought out plan for Sea Week and present it to your administrators for approval.

IV. Talk to teachers in the upper grades about having some of their students accompany you on your field trips. Brief them ahead of time as to the activities you'll be doing.

V. Make up a calendar of when speakers will talk, which movies will be shown, and when each class will take their field trips. By arranging two field trips near one another in location, or by having the second class come to the beach when the first field trip of the day is leaving, gas (and energy) can be saved by having fewer bus trips.

VI. Invite the whole community to participate - parents, chamber of commerce, governmental agencies, native corporations, fishermen, etc. Parents can assist with field trips; businesses might display student artwork. If community organizations are interested, the week can become a Festival of the Sea, with boat tours, movies, speakers, games, and dances. Contact your local paper about featuring Sea Week with a photo and story - beforehand, during, and afterwards! Radio stations might want to interview field trip leaders - or read stories that students have written.

VII. Spend an entire week studying the amazing ocean! Math problems, writing assignments, spelling words - can all relate to our marine environment. Show your students the wonder of sea life!

Appendix II

SUGGESTED FIELD TRIPS

In planning field trips for your class two things should be considered: 1. The emphasis in Sea Week studies at your grade level. 2. The available community resources.

Consider visiting a place - beaches, docks, vessels (fishing, pleasure, ferry, barge, tour ship, Coast Guard), cold storage plant, canneries, supermarket, government research facilities, hatcheries. Museums, private collections and stores might be considered for indoor trips. Arrangements might be made to watch someone at work - fisherman, biologist, or Coast Guard personnel. If your students have an opportunity to visit another community you might include Sea Week activities in your itinerary or might include the entire trip around them.

In planning any trip, if possible arrange for knowledgeable persons to accompany your group. The involvement of interested parents is also valuable.

FIRST GRADE

I. Beach - Activities for one or many trips (to a good rich-in-life beach during a very low tide) are outlined in the guide. Take advantage of the opportunity to observe such things as sea mammals, herring, etc. when they are present.

II. Water Safety - flotation gear, boating, fishing, tide action, swimming.

A. Coast Guard has movies and programs for young children.
B. Fire Dept., Police and Health Dept. have safety programs.

III. Collections of life from the sea - preserved displays often can be found in museums, stores and homes.

IV. Collections - live - Government agencies, museums, or other classrooms.

WHAT TO DO ON THE BUS

Put together a checklist of objects (or use the one that follows) that the students may see at the beach. During the bus ride, students can circle the name (or picture) of each object that they think they will be seeing during the field trip. At the beach, they can check off the objects they actually saw, and estimate or count how many they saw. A Juneau teacher makes her checklists into a small book, with a pencil attached by yarn, and gives each pupil a sandwich bag in which to store his/her checklist.

bus	_____	cow	_____
can	_____	raven	_____
fish	_____	sheep	_____
tree	_____	driftwood	_____
gull	_____	boat	_____
buoy	_____	moose	_____
anemone	_____	dock	_____
whale	_____	starfish	_____
seaweed	_____	house	_____
crab	_____	airplane	_____
bottle	_____	fisherman	_____
jellyfish	_____	limpet shell	_____
sand flea	_____	sea urchin	_____
mussel	_____	porpoise	_____

CONSERVATION

Conservation may be defined as the "wise use" of our natural resourc It is not the non-use of them, but rather a use that comes after car ful thought has been given to the reasons and consequences of that u

It is perhaps trite to say that with increasing population pressures the ever-increasing need for raw materials, for recreational facilit for homesites, etc., pressures increase on a natural environment tha may previously have been untrammeled and in no need of someone to pr it from total alteration. Here in Alaska, particularly, the residen of the State are faced with making many immediate far-reaching decis about the natural environment of our State. What man's impact on it will be and if and how that impact should be limited or controlled a some of these decisions.

Conservation, practically, comes down to a few important principles:

1. Every living thing, as well as non-living thing, has a place an function in the balance of existence on the surface of this planet, whether or not we happen to know what its precise niche is. "Every- thing is connected with everything else." "Everything affects every thing else." Destruction of one species, useless and unimportant though that species may seem to our ignorance, can have wide-reachin repercussions.

2. Natural resources are exhaustible. Populations which drop below a critical threshold cease to reproduce and the species plummets int extinction. Energy resources on earth are not renewable. Extinctio of living species and exhaustion of non-living resources are natural processes. Trilobites went extinct before men appeared on the scene Volcanoes spew noxious gases into the air. Nevertheless, the speed with which man, especially 20th century man, is destroying or using extant life and resources is astronomical compared to natural proces

3. Since man is an intelligent being, he can, if he will, desist from extinguishing life and exhausting the resources of the earth. M can practice conservation without denying himself a full and enjoyab life. His reason for using resources wisely may be an idealistic appreciation of all that nature has and is, or it may be a realizati that our tomorrows will be poorer unless wisdom regulates usage of o goods.[1]

For school children studying Alaska's marine life, conservation invo a few simple, yet extremely important principals:

1. DO VISIT THE BEACH AND ENJOY YOUR TIME THERE BUT WHEN YOU LEAVE LET THE AREA BE THE SAME, OR BETTER, THAN YOU FOUND IT.

2. IF YOU TURN OVER A ROCK TO SEE WHAT IS HIDING UNDER IT, TURN IT BACK OVER WHEN YOU HAVE FINISHED. (What lives there may depend for survival on the exact kind of micro-habitat that exists und that rock.)

[1] Reef and Shore. Hawaii Nature Study Program for Elementary School Children, p. 4.

3. IF YOU PICK UP ANIMALS FOR CLOSER VIEWING, DISTURB ONLY THE ONES YOU WANT TO LOOK AT, HANDLE THEM CAREFULLY, THEN REPLACE THEM WHERE YOU FOUND THEM. SEA CREATURES CAN LIVE OUTSIDE OF THE WATER ONLY BRIEFLY. A PAN OR BUCKET OF SEAWATER WILL ALLOW CLOSER EXAMINATION AND REDUCE STRESS ON THE ANIMAL. KEEP THE CONTAINER OUT OF DIRECT SUNLIGHT AND REPLACE THE WATER IF IT BEGINS TO WARM. HANDLE FISH WITH WET HANDS TO PRESERVE THEIR PROTECTIVE SLIME AND IN HANDLING CRABS AND JELLYFISH - WATCH OUT FOR STINGERS AND PINCHERS. PICK CRABS UP FROM THE BACK AND SUPPORT THEIR UNDERSIDE WITH THE PALM OF YOUR HAND. DON'T TOUCH JELLYFISH.

4. IF YOU WANT TO USE LIVE MATERIALS IN THE CLASSROOM AFTER THE FIELD TRIP TO THE BEACH, TAKE ONLY WHAT YOU WILL NEED, TAKE CARE TO KEEP IT ALIVE, AND RETURN IT TO THE BEACH WHEN YOU ARE FINISHED WITH IT.

5. NON-LIVING BEACH MATERIALS MAY BE COLLECTED BUT USE MODERATION HERE, TOO. IF MATERIALS ARE FOR GLASS USE, HAVE A PROJECT IN MIND BEFORE YOU BEGIN COLLECTING AND THEN GATHER ONLY WHAT YOU WILL NEED. YOU MAY WANT TO GATHER DRIFTWOOD, STONES, BITS OF POLISHED GLASS. UNLESS YOU ARE A SECOND GRADE TEACHER, HOWEVER, PLEASE COLLECT ONLY A FEW, IF ANY, EMPLY SHELLS LEAVING THESE MATERIALS FOR THE SECOND GRADERS WHOSE ONLY SEA WEEK BEACH AND CLASSROOM ACTIVITY IS STUDYING THEM.

Appendix V

A CHECK LIST

FOR

A FIELD TRIP TO THE BEACH

You the teacher:

1. Be sure you are personally familiar with the beach to which you and your class are going. If you have not been there before, take a bit of time after school or on the weekend to go to that beach and walk it carefully. By being familiar with it yourself, you can anticipate what your students will be able to see and do there.

2. Check carefully on all bus arrangements for your class. Be sure that a bus is scheduled for you and be aware of the delivery and pick-up times.

3. Arrange for adequate adult supervision. Usually there is no problem in finding parents willing to go along. Often junior or senior high school students may also be available and, if they are taking biology or other related science courses, they can be very helpful. One older student or adult for every five or six children would be a good ratio in terms of safety, control, and learning.

4. Give careful thought to what you will do with your time at the beach. The beach is an exciting place just to explore, but some thought and directions given to the activities to take place will make the experience richer and more profitable for students and you, too.

5. Meet - or at least talk by phone - with your volunteers before the field trip to acquaint them with your plans for the outing. Be sure that each of them knows specifically what you would like each to do. Recommend that they attend appropriate training workshops and provide them with information from this guide or elsewhere.

6. Well in advance of the beach trip itself, begin preparing your students for their experiences there. The better prepared they are, the more successful the field trip will be.

7. Letters should be written to all parents, including permission slips, so that parents know about the activities in which their children will be involved.

8. Collect and ready all materials you will need for the field trip - buckets, pans, binoculars, camera, whatever it is you need. You might consider bringing or arranging for some kind of snack at the beach - a big bag of gorp (M & M's, raisins, salted peanuts, etc.) always makes a hit and a snack can serve

to reorganize matters at the beach and create a natural (though slightly contrived) change of pace and focus. (see the suggested time.plan that follows.) Be sure to take along a supply of bandaids - or better yet, a small first-aid kit - just in case there is a need for it.

9. Plan the trip ahead, but allow for flexibility. If a whale is breaching just off shore while you are trying to teach the life and ways of a barnacle, your students will not be absorbing much of your lecture. Be prepared to take advantage of those special events that occur so often along our shores.

The students:

1. Involve them in preparing for the field trip as much as possible.

2. Explain to them any rules for field trip conduct. Stress especially the fact that the beach is a special environment and a fragile one whose beauty comes from the LIVING plants and animals to be found there. Impress upon them the need to respect the life forms they will see, to leave the beach as nearly like they find it as possible and not to collect or molest live beach animals unless you, the teacher, have very specific and well thought out needs for limited quantities of live animals and materials for use in further teaching processes and have requested the students help you gather materials.

3. A quick talk about safety at the beach would not be out of place - the need for proper clothing, care to be taken on rocks that are slippery when wet, what to do in case of injury, always keep an eye on the tide to be sure you are not stranded or lose gear to the rising waters, etc.

4. If a class project is planned for the beach time, help students to prepare or gather materials they will need to take with them.

BOTH teacher and students:

BE PROPERLY DRESSED. It is always difficult to predict what the weather will be in coastal Alaska but there is often a good chance that there may be rain. Be sure everyone knows that he or she should come dressed warmly and prepared for rain if that prospect seems at all likely. Wearing layers of clothes always makes sense - a short sleeved shirt, then something with long sleeves, topped by a sweater or warm jacket and something water and wind-proof. Foot gear is important. Layer socks for maximum warmth and wear RUBBER boots if possible. Carrying a back pack is a good idea for students and teachers alike. It leaves your hands free, lets you store away layers of clothes you want to shed or don't need at the moment and is a good place to keep the snack you and/or the students have decided to bring along.

Appendix VI

SUGGESTED ON-SITE ORGANIZATION

The beach is an exciting place on your first visit there or your five hundredth and the most normal and natural thing to do on the beach is to walk - or run - along the shoreline to see what is there for the finding. If your class has been working hard on sea related studies and has carefully outlined what they want to do with their time at the beach, then perhaps all students will set right to work with whatever tasks have been outlined beforehand. But, if a less structured approach seems to be in order, you might try the following idea...

Part I

If, before the beach experience, you have been working in the classroom with the students on the particular area of marine knowledge outlined for your grade level, then the students should have a good idea of particular concepts or kinds of life or situations they might look for at the beach. Students could have the first half of the time at the beach to apply their knowledge in a free kind of framework. That is, for example, if you are a second grade teacher and have been studying shells with your students, give them the first part of their time at the beach to see how many different kinds of shells they can count, or give them some other similar kind of task that they can carry out and at the same time still be free to explore other aspects of the beach.

Part II

At the mid-point of your allotted time at the beach, gather the children together. Taking a bit of time out to open that big bag of gorp, or gathering for some other kind of snacking, works to draw everyone together, change the pace and focus.

After the quick energy break is a good time to have the students sit down quietly and talk about what they have seen or to have adult helpers work in small groups with children to share further discoveries or knowledge about materials found on the beach. As an example, if you are a first grade teacher who has been studying marine animals with your class, each adult helper might have been assigned to gather in a bucket - with the children's help - examples of a particular group of animals during the first part of the time on the beach. Then, during the second half of the beach time, each adult and his or her bucket of materials might circulate from one small group of children to the next, encouraging them to touch, feel, observe certain characteristics or qualities of these particular animals.

Children need both to enjoy the beach just for the pleasure there is in being there and to grow in understanding the complex web of life and environmental factors that are at work there. If careful thought and planning have gone on well before the actual trip to the beach, there is every reason to believe that both these goals can be accomplished.

A LOOK AT THE BEACH

Any beach is as individual in its own way as are we who, as individuals can be distinguished from all other people. Just as each of us represents only one combination out of the many possible, so it is with beaches. A beach is a place where the sea confronts the land, and every aspect of that sea and that land edge is important in determining what the general appearance of that beach will be and what kinds of plants and animals will grow and thrive in that particular environment. Many factors combine to determine the personality of that unique and special place.

The Sea

If we think first about the water at the beach, we realize that there are several ways in which it can vary. To begin with, for example, those of us living in the Juneau area look out to waters that are relatively protected. That is, our beaches are not subjected to the open, powerful swells that are common on coast lines that abut the open ocean. Unlike conditions that might be found at Sitka, for example, the wave conditions along our beaches are always relatively mild and non-violent. Even in the Juneau area, however, local differences in topography influence the personality of the beach. Whether a particular beach area is a straight, uninterrupted stretch, a deep or shallow cover, or a jutting point will influence the force and effect of the waves upon the shore. Consequently, we might expect to find different kinds of life on a point, in a cove, or on a straight, uncomplicated shoreline because each species has a particular ability to withstand greater or lesser wave force.

We all know that the sea is salty but we may not all realize that the concentration of salt in sea water can be highly variable. In the open ocean, salt concentrations measure about 32 to 33 parts per thousand. In our inside waters around Juneau, the average salt concentration in main channels may be slightly less than that because of the greater influence of fresh water entering from streams and rivers. At the mouths of the streams and rivers themselves, where salt and freshwater mix, salt concentrations are very low. Because each kind of marine plant or animal has its own built-in tolerances to varying saltiness or freshness, these living populations vary with the salinity prevalent at a particular place.

THE SIZE OF PEBBLES

If you stand on a beach and look thoughtfully at it, one of the first things you will notice is its texture - whether it is sandy, gravelly, composed of cobbles, bedrock, mud or a combination of two or more of these. The nature of the beach is critical in determining what can live there. Let's examine each kind of substrate in turn to see what kind of life we might expect to find.

Mud

Mud can be anything from relatively porous sand-soil mix to the clay muck that sucks rubber boots right off your feet. If you look at the surface of this kind of substrate, you will be aware of little, if any, life. Here and there you may see the flexible tubes of mud dwelling worms sticking up an inch or so above the surface. Or you may see "cake decorations" left by other burrowing worms. Finally, you may be aware of the presence of clams by the squirts of water and the siphon holes in the mud. Digging with a shovel will reveal the various inhabitants of the mud in all their glory - fat, bulbous peanut worms: slender, earthworm-like nemerteans of various descriptions; many-legged annelid worms; and hardy bivalves.

Sand

Because sand is more porous than mud, it is a better surface for many burrowers, a better surface for a wider number of animals to live on and in. On a sand flat at low tide one may find starfish, sea urchins, and numerous kinds of crabs and snails. Some of these animals wander over the sand flats when they are submerged, scouring them for bits of food. Some crabs, like the Dungeness, tend to stay in sandy areas because of the methods of self-protection involves burrowing into the sand to hide. (Even when the sand is exposed, watch for depressions in the surface that mimic the shape of the crab's shell. By digging there, you may uncover a crab that stayed buried even as the water receded.) By looking for clam or cockle siphon holes, you will discover these common residents of sandy areas and by digging carefully you may unearth them.

Cobbles and Boulders

Obviously, the size of loose rocks on the beach may range from something just a bit coarser than sand up to boulders too large to be lifted. In general, the larger the general size of the rock pieces, the greater variety of life one might expect to find there. The more stable the hard surface is, the greater protection and anchors it can afford a resident plant or animal. Intertidal areas of cobbles or rocks are often most obviously serving as anchorages for marine plants (most common in the Juneau area, Fucus, the rockweed, the tough, ubiquitous, brown plant with the bulbous reproductive bodies that kids like to pop) and for barnacles and blue mussels that may cover certain rocks of sections of beach in great density. If you begin to look down among the beds of rockweed, barnacles, and mussels and UNDER cobbles and boulders, you will discover an amazing diversity of life forms. Small six-rayed starfish cling beneath medium sized rocks, often brooding clutches of eggs. Blennies up to six inches or so in lenth (one of the two most common intertidally discovered fish) hide under rocks. So do amphipods or sand fleas and tiny crustacean beach scavengers that quickly seek new cover when discovered under their protective rock. Clinging to the surface of the rocks may be limpets, chitons, sponges. Look for the latter particularly under overhangs of larger rocks.

Because of their ability to serve as anchors and because they offer so many protective niches, rocks on beaches afford some to the best looking places. Don't neglect to have along a magnifying glass so you can really see some of the tiny critters! Guaranteed that the more your look, the more you will see there! Just be very sure that after you turn over a rock to reveal its underside residents, that you replace it so the animals don't dry out and perish!

Bedrock

This is just as exciting a place to poke as cobbles/boulder areas and many of the same inhabitants can be found here -- with two general kinds of exceptions. First, obviously this rock surface can't be turned over so the "rock and sand or mud residents" are not here. Second, it is in bedrock areas that you are most apt to find remnant puddles of water - tidepools - that may harbor lots of life, including small anemones with tentacles extended to trap food (they come in a wide variety of gorgeous color combinations), rock hard coralline algae that looks like hard, pink plaster but are actually living plants, tiny immature sculpins, and perhaps little shrimp. Be sure to look carefully in crevasses for sponges, starfish, and other creatures.

THE DISTANCE FROM THE WATER

Each species of marine plant and animal has a particular tolerance to being out of salt water. Some of them, for example, are never found intertidally because they have absolutely no tolerance for exposure to the effects of an air environment. Others can stand being out of salt water for extended periods of time, needing only to be wet by the sea on occasional very high tides. By looking at the beach in a section from its highest high water mark down to the water level on a low, low tide, you can quickly begin to see major differences in plant and animal populations.

The Highest Fringe

At the upper limits of the intertidal zone, least life forms are evident. You may notice that the rocks appear black here. This is because they are covered by a black encrusting lichen or by a blue-green algae that makes these rocks treacherous and slippery when wet. In these upper reaches, too, may be found the common tiny periwinkle - a fat, ridged snail that sometimes seems to pepper the rocks.

The Middle Zone

As you move down toward the water's edge on a low tide, you will be aware of obvious color bands or patches on the beach. There may be banding of Fucus, the common brown rockweed, and of blue-black mussels (the intertidal - and subtidal - bivalve that attaches itself by tiny threads to rocks and pilings and other surfaces), and barnacles. Here too you will begin to see limpets (the species of which are sometimes most quickly identified by how low or high they are found on the beach), amphipods, various starfish, tiny black sea cucumbers, and other forms of life there were not in evidence at higher levels.

The Lowest Zone

As you approach the water's edge, you will not find some of the plants and animals that were evident at higher levels. In general, however, the lower you go in the intertidal zone the greater the diversity of life forms you will find. Here you will find sea urchins, a wide variety of often large starfish, perhaps juvenile king crabs, large white or varicolored sea anemones (if they are out of water, these will look like squishy, uninviting blobs, but look out into the shallow waters to see the same animals in all their expanded glory), and the larger snails.

So...as you look at any particulat beach for the first time, there is a great deal to think about. Remember that each part of the beach, each kind of surface type, each height from the water, each kind of topographical variation indicates what life may be found there. In general, it is advisable to spend the lowest part of the tidal cycle closest to the water's edge for in that way you will have the maximum amount of time to spend along the beach area that is revealed to us least often and which tends to harbor the greatest diversity of plants and animals.

If you can, acquaint your students with these obvious or subtle variations in the beach habitat for it will enrich their beach experience, too!!!

TIDES

Students can understand some basics about tides and should definitely learn that the height of the water on the beach varies with the stage of the tide and that maximum and minimum tidal levels vary each day.

Tides, in a very simplified kind of explanation, occur because of the gravitational pull of the sun and the moon on the earth. Just as the earth exerts gravitational force (why does an apple fall? why can't we step off into space?), so do these other two bodies. The force of the pull of the sun and moon on a particular place on earth depends on how directly they are in line with that place. The force they exert tends to pull the water away from the earth's surface on the side of the earth facing, thus causing a high tide. Because the relative position of the sun, earth, and moon are constantly changing in a cyclic rhythm, so are the tides.

Activities

Here in Southeast Alaska we experience a tidal cycle that consists of two unequal high tides and two unequal low tides each day. With some students in primary grades and all those in upper grades, you might sit down with a tide table and look at the numbers and explain what they mean. You might even make a simple chart of tide levels and of activities to coincide with various stages of the tide. For instance, it might be much easier to launch a boat when the tide is high but digging clams can best be done on the very lowest tide. Students might be shown the same beach at high and at low tide and through words or art work compare the differences.

Preparation for Field Trip

In preparing for the field trip, discuss tides with the students. Mention the need to be as close to the water as possible when the tide is at its lowest in order to see that strip of beach and the life that is there, for the water quickly comes in and covers it. Talk, too, about the need to be aware of the tide level and thus not to set a pack or bucket next to the water's edge and expect to find it there later if the tide is flooding.

As a teacher you need to be aware of the time of low tide when scheduling your field trip to the beach and in planning the activities that will take place there. The time of very lowest tide should be kept open for observation of what is to be found in the zone nearest the water. Activities such as taking a break for a snack or gathering around buckets to discuss and examine particular animals should occur when the tide is ebbing or flooding.

Appendix IX

A BIBLIOGRAPHY OF HELPFUL REFERENCES

Field Guides

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University of Alaska. Alaska Sea Grant Program. *Alaska Tidelines,* a Sea Grant Publication for Alaska Schools. Fairbanks.

Plus +++ check with agencies in your area, aquaculture associations, the U. S. Coast Guard, local corporations to see what publications they may have available.

OTHER LEARNING AIDS

The Alaska State Museum has multi-media learning kits available for use by Alaskan schools, including a Salmon kit. Priority use is given to bush schools. Write: Alaska State Museum, Pouch FM, Juneau, Alaska 99811.

Your school can order films through the Alaska State Film Library. Their marine science/oceanography listings are too numerous to mention, but some topics that are dealt with include: marine invertebrates, ocean currents, the beach, whales, life cycle of the salmon, mollusks, tide pool life, marine science careers, sea birds, octopus, the ocean as a food source, fishing techniques, the ecology of the ocean, and seacoast cultures.

The Smithsonian Institution is currently field testing a binder of estuary study activities ($9.68). Activities include: Beachcombing, Mapping, Barnacles, Build A Trap, Fish Adaptations, Fish, Marsh Muck, Crabs, Water in Motion, Menance Oil Slick, Oil Spill Cleanup, and Estuary 3-D Board. For more information write:

SEA (Smithsonian Estuarine Activities)
Chesapeake Bay Center For Environmental Studies
Smithsonian Institution
P. O. Box 28
Edgewater, Maryland 21037

Posters on beach safety and pamphlets on tides, whales, crabs, and other marine topics are available from the Oregon State University Sea Grant Marine Advisory Program. For a catalog and price list (many are free) write:

Extension Communication-Marine Advisory Program
Oregon State University Ads 422
Corvallis, OR 97331

ALASKA SEA WEEK EVALUATION FORM

computer code numbers

1. Town or village _____ (1-4) (5)

2. Grade level _____ (6-7)

3. Number of students involved _____ (8-10)

You may need to review your Alaska Sea Week materials to answer these questions.

4. How many classroom (indoor) activities and worksheets did you use from each book?

Book (Grade level)	Number of activities	
Discovery (K)	_____	(11-12)
Sea Animals (1)	_____	(13-14)
Shells (2)	_____	(15-16)
Glacial & Intertidal Ecology (3)	_____	(17-18)
Birds (4)	_____	(19-20)
Fish (5)	_____	(21-22)
Man's Influence on the Sea (6)	_____	(23-24)

5. What is the total number of field (outdoor) activities used from the 7 books? _____ (25-26)

6. How many periods (1 hr. each) did your class spend on the Sea Week Program? _____ (27-29)

Please check the appropriate box to the right of each question.

	decidedly yes	yes	no opinion	no	decidedly no	
7. Were the Alaska Sea Week materials relevant to your curriculum?	(1)	(2)	(3)	(4)	(5)	(30)
8. Did the Sea Week materials motivate students to improve their math, reading, & writing skills?	(1)	(2)	(3)	(4)	(5)	(31)
9. Did the Sea Week materials upgrade your science program?	(1)	(2)	(3)	(4)	(5)	(32)
10. Did students enjoy the Sea Week activities?	(1)	(2)	(3)	(4)	(5)	(33)
11. Did students develop a greater awareness, appreciation, and respect for the sea?	(1)	(2)	(3)	(4)	(5)	(34)
12. Did students develop decision-making skills necessary for resolution of marine issues?	(1)	(2)	(3)	(4)	(5)	(35)
13. Was the material appropriate for your students' grade level?	(1)	(2)	(3)	(4)	(5)	(36)
14. Was the teacher background section adequate?	(1)	(2)	(3)	(4)	(5)	(37)
15. Were the teacher instructions helpful & complete?	(1)	(2)	(3)	(4)	(5)	(38)
16. Were parents and other community members involved in your Sea Week?	(1)	(2)	(3)	(4)	(5)	(39)
17. Were parents favorably impressed with the Sea Week Program?	(1)	(2)	(3)	(4)	(5)	(40)
18. Did Sea Week help improve the relationship of the school to the community?	(1)	(2)	(3)	(4)	(5)	(41)

19. Rate your overall feelings about the Sea Week MATERIALS on a scale of 1 to 5. _____ (1=high; 5=low) (42)

20. Rate your overall feelings about the Sea Week PROGRAM on a scale of 1 to 5. _____ (1=high; 5=low) (43)

(OVER, PLEASE)

21. How many teachers are in your school? ____
How many are using Sea Week materials? ____ (44-

22. Do you plan to introduce the Sea Week materials to other teachers? yes____(1)
no____(2) (46)

23. Do you plan to use the Sea Week materials again? yes____(1) no____(2) (47)

24. Would you be interested in attending a marine education/Sea Week workshop?
yes____(1) no____(2) (48)

If so, list your name and school address:

Name _____

Address _____

25. What other comments do you have? Are there any specific improvements you would suggest?

Please return this completed form to Jill Thayer/Belle Mickelson, Alaska Sea Grant Progr
University of Alaska, Fairbanks, Alaska 99701.